DELTA ELECTRONICS, INC.

DELTA AC SERVO SYSTEM

ASDA-A Series

User Manual

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ASIA
DELTA ELECTRONICS, INC.
Taoyuan Plant/
31-1, SHIEN PAN ROAD, KUEI SAN
INDUSTRIAL ZONE, TAOYUAN SHIEN,
TAIWAN
TEL: 886-3-362-6301
FAX: 886-3-362-7267
www.delta.com.tw/industrialautomation

NORTH/SOUTH AMERICA
DELTA PRODUCTS CORPORATION
Sales Office/
P.O. BOX 12173
5101 DAVIS DRIVE
RESEARCH TRIANGLE PARK,
NC 27709, U.S.A.
TEL: 1-919-767-3813
FAX: 1-919-767-3969

EUROPE
DELTRONICS (NETHERLANDS) B.V.
DE WITBOGT 15
5652 AG EINDHOVEN
THE NETHERLANDS
TEL: 31-40-2592860
FAX: 31-40-2592851

DELTA ELECTRONICS (JAPAN) INC.
DELTA SHIBADAIMON BLDG.
2-1-14 SHIBADAIMON, MINATO-KU,
TOKYO, 105-0012, JAPAN
TEL: 81-3-5733-1111
FAX: 81-3-5733-1211

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AC Servo System ASDA-A Series User Manual

Preface

Thank you very much for purchasing DELTA's AC servo products. This manual will be helpful in the installation, wiring, inspection, and operation of Delta AC servo drive and motor. Before using the product, please read this user manual to ensure correct use. You should thoroughly understand all WARNINGS and CAUTIONS before proceeding with the installation, wiring and operation. If you do not understand, please contact your local Delta sales representative. Place this user manual in a safe location for future reference.

🕮 Using This Manual

■ Contents of this manual

This manual is a user guide that provides information on how to install, operate and maintain ASDA-A series AC servo drives and ASMT series AC servo motors. The contents of this manual are including the following topics:

- Installation of AC servo drives and motors
- Configuration and wiring
- Trial run steps
- Control functions and adjusting methods of AC servo drives
- Parameter settings
- Communication protocol
- Inspection and maintenance
- Troubleshooting
- Application examples

■ Who should use this manual

This user manual is intended for the following users:

- Those who are responsible for designing.
- Those who are responsible for installing or wiring.
- Those who are responsible for operating or programming.
- Those who are responsible for maintaining or troubleshooting.

■ Important precautions

Before using the product, please read this user manual thoroughly to ensure correct use and store this manual in a safe and handy place for quick reference whenever necessary. Besides, please observe the following precautions:

- Do not use the product in a potentially explosive environment.
- Install the product in a clean and dry location free from corrosive and inflammable gases or liquids.
- Do not connect a commercial power supply to the U, V, W terminals of motor. Failure to observe this precaution will damage either the Servo motor or drive.
- Ensure that the drive and motor are correctly connected to a ground. The grounding method

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must comply with the electrical standard of the country.

- Do not disconnect the AC servo drive and motor while the power is ON.
- Do not attach, modify and remove wiring when power is applied to the AC servo drive and motor.
- Before starting the operation with a mechanical system connected, make sure the emergency stop equipment can be energized and work at any time.
- Do not touch the drive heat sink or the servo motor during operation. Otherwise, it may result in serious personnel injury.

⚠ SAFETY PRECAUTIONS

ASDA-A series drives are open type, variable frequency and insulated gate bipolar transistor AC monitor controller incorporating microprocessor technology. They are operated from a single or three-phase source of supply, and intended to control three-phase permanent magnet synchronous motors (PMSM) by means of a variable frequency, variable voltage output, used in industrial applications and for installation in an end-use enclosure. Drives, cables and motors are for use in a suitable enclosure with a minimum of a UL Type 1 rating.

Carefully notice and observe the following safety precautions when receiving, inspecting, installing, operating, maintaining and troubleshooting. The following words, **WARNING** and **CAUTION** are used to mark safety precautions when using the Delta's servo products. ***Failure to observe these precautions may void the warranty!***

The words, **WARNING** and **CAUTION**, have the following meaning:

⚠ **WARNING**	Indicates a potentially hazardous situation and if not avoided, may result in serious injury or death.
⚠ **CAUTION**	Indicates a potentially hazardous situation and if not avoided, may result in minor to moderate injury or serious damage to the product.

■ Unpacking Check

⚠ **WARNING**	● Please ensure that both the servo drive and motor are correctly matched for size (power rating). Failure to observe this WARNING may cause fire, seriously damage the drive / motor or cause personal injury.

■ Installation

⚠ **CAUTION**	● Do not install the product in a location that is outside the stated specification for the drive and motor. Failure to observe this caution may result in electric shock, fire, or personal injury.

■ Wiring

⚠ **WARNING**	● Connect the ground terminals to a class-3 ground (Ground resistance should not exceed 100 Ω). Improper grounding may result in electric shock or fire.

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⚠ CAUTION

- Do not connect any power suppies to the U, V, W terminals. Failure to observe this precaution may result in serious injury, damage to the drive or fire.
- Ensure that all screws, connectors and wire terminations are secure on the power supply, servo drive and motor. Failure to observe this caution may result in damage, fire or personal injury.

■ Operation

⚠ WARNING

- Conduct trial run on the servo motor with motor shaft disconnected from its mechanical system to avoid any accidents.
- Do not approach or touch any rotating parts (e.g. shaft) while the motor is running. Failure to observe this precaution may result in serious injury to personnel.
- Before starting the operation with a mechanical system connected, change the drive parameters to match the user-defined parameters of the mechanical system. Starting the operation without matching the correct parameters may result in servo drive or motor damage, or damage to the mechanical system.
- Ensure that the emergency stop equipment or device is connected and working correctly before operating the motor that is connected to a mechanical system.
- Do not touch either the drive heat sink or the motor during operation as they may become hot and personal injury may result.

■ Maintenance and Inspection

⚠ WARNING

- Do not touch any internal or exposed parts of the servo drive as electric shock may result.
- Do not remove the operation panel while the drive is connected to an electrical power source otherwise electrical shock may result.
- Wait at least 10 minutes after power has been removed before touching any drive or motor terminals or performing any wiring and/or inspection as an electrical charge may still remain in the drive and motor with hazardous voltages even after power has been removed.
- Do not disassemble the servo drive or motor as electric shock may result.
- Do not connect or disconnect wires or connectors while power is applied to the drive and motor.
- Only qualified personnel who have electrical knowledge should conduct maintenance and inspection.

■ Main Circuit Wiring

⚠ CAUTION

- Use multi-stranded twisted-pair wires or multi-core shielded-pair wires for signal, encoder (PG) feedback cables. The maximum length of command input cable is 3m and the maximum length of encoder (PG) feedback cables is 20m.

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⚠CAUTION

- Install the encoder cables in a separate conduit from the motor power cables to avoid signal noise. Separate the conduits by 30cm.
- As a charge may still remain in the drive with hazardous voltages even after power has been removed, be sure to wait at least 10 minutes after power has been removed before performing any wiring and/or inspection.
- It is not recommended to frequently power the drive on and off. Do not turn the drive off and on more than once per minute as high charging currents within the internal capacitors may cause damage.

■ Main Circuit Terminal Wiring

⚠CAUTION

- Remove the terminal block from the servo drive before wiring.
- Insert only one wire into one terminal on the terminal block.
- When inserting wires ensure that the conductors are not shorted to adjacent terminals or wires.

■ Trial Run without Load

⚠CAUTION

- In order to prevent accidents, the trial run for servo motor should be conducted under no load condition (run the servo motor alone without connecting couplings and belts).
- For the initial trial run, do not operate the servo motor while it is connected to the mechanical system. Connecting the motor to its mechanical system may cause damage during the trail run. Connect the servo motor once it has successfully completed a trail run.

■ Trial Run with Load

⚠CAUTION

- After the trial run without load is completed, conduct a second trial run with load.

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Delta AC Servo Drive and Servo Motor

[ASDA-A Series] User Manual

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About this Manual...

User Information

Be sure to store this manual in a safe place.

Due to constantly growing product range, technical improvement and alteration or changed texts, figures and diagrams, we reserve the right of this manual contained information change without prior notice.

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Technical Support and Service

Welcome to contact us or visit our web site (http://www.delta.com.tw/industrialautomation/) if you need any technical support, service and information, or, if you have any question in using the product. We are looking forward to serve you needs and willing to offer our best support and service to you. Reach us by the following ways.

ASIA
DELTA ELECTRONICS, INC.
TAOYUAN Plant/
31-1, SHIEN PAN ROAD, KUEI SAN
INDUSTRIAL ZONE TAOYUAN 333,
TAIWAN
TEL: 886-3-362-6301
FAX: 886-3-362-7267

JAPAN
DELTA ELECTRONICS (JAPAN) INC.
Sales Office/
DELTA SHIBADAIMON BLDG.
2-1-14 SHIBADAIMON, MINATO-KU,
TOKYO, 105-0012, JAPAN
TEL: 81-3-5733-1111
FAX: 81-3-5733-1211

NORTH/SOUTH AMERICA
DELTA PRODUCTS CORPORATION
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P.O. BOX 12173
5101 DAVIS DRIVE
RESEARCH TRIANGLE PARK,
NC 27709, U.S.A.
TEL: 1-919-767-3813
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EUROPE
DELTRONICS (NETHERLANDS) B.V.
Sales Office/
DE WITBOGT 15
5652 AG EINDHOVEN
THE NETHERLANDS
TEL: 31-40-259-2850
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Chapter 1 Unpacking Check and Model Explanation

1-1 Unpacking Check

After receiving the product, please check for the following:

- **Ensure that the product is what you have ordered.**

  Verify the part number indicated on the nameplate corresponds with the part number of your order (Please refer to Section 1-2 for details about the model explanation).

- **Ensure that the servo motor shaft rotates freely.**

  Rotate the motor shaft by hand; a smooth rotation will indicate a good motor. However, a servo motor with an electromagnetic brake can not be rotated manually.

- **Check for damage.**

  Inspect the unit to insure it was not damaged during shipment.

- **Check for loose screws.**

  Ensure that all necessary screws are tight and secure. If any items are damaged or incorrect, please inform the distributor whom you purchased the product from or your local Delta sales representative.

A complete and workable AC servo system should be including the following parts:

Part I : Delta standard supplied parts

(1) Servo drive

(2) Servo motor

(3) 5 PIN Terminal Block (for L1, L2, R, S, T)

(4) 3 PIN Terminal Block (for U, V, W)

(5) 3 PIN Terminal Block (for P, D, C)

(6) One operating lever (for wire to terminal block insertion)

Part II : Optional parts, not Delta standard supplied part (Refer to Appendix A)

(1) One power cable, which is used to connect servo motor and U, V, W terminals of servo drive. This power cable is with one green grounding cable. Please connect the green grounding cable to the ground terminal of the servo drive.

(2) One encoder cable, which is used to connect the encoder of servo motor and CN2 terminal of servo drive.

(3) CN1 Connector: 50 PIN Connector (3M type analog product)

(4) CN2 Connector: 20 PIN Connector (3M type analog product)

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(5) CN3 Connector: 6 PIN Connector (IEEE1394 analog product)

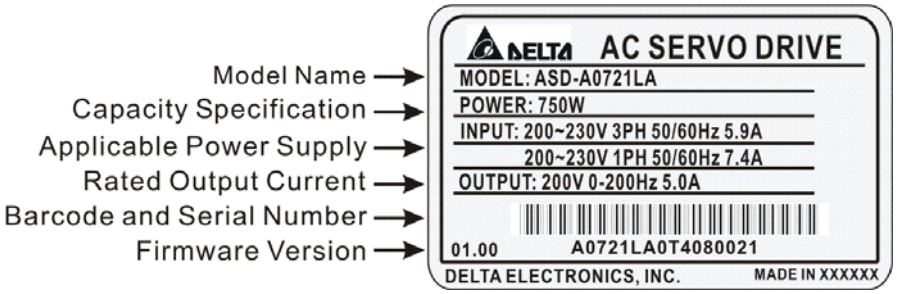
Delta AC Servo Drive and Motor

1-2 Model Explanation

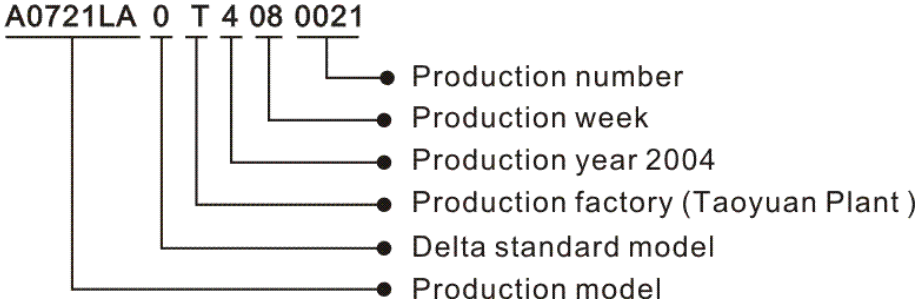
1-2-1 Nameplate

ASDA-A Series Servo Drive

- Nameplate Explanation



- Serial Number Explanation



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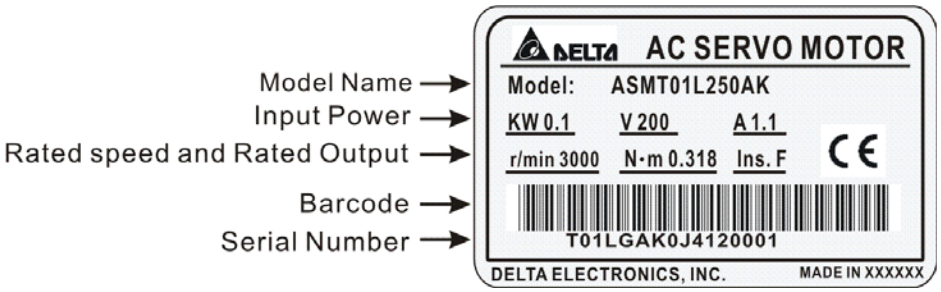
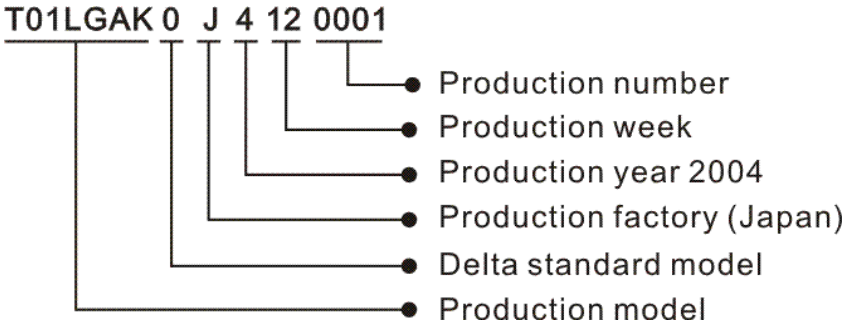
ASMT Series Servo Motor

- Nameplate Explanation

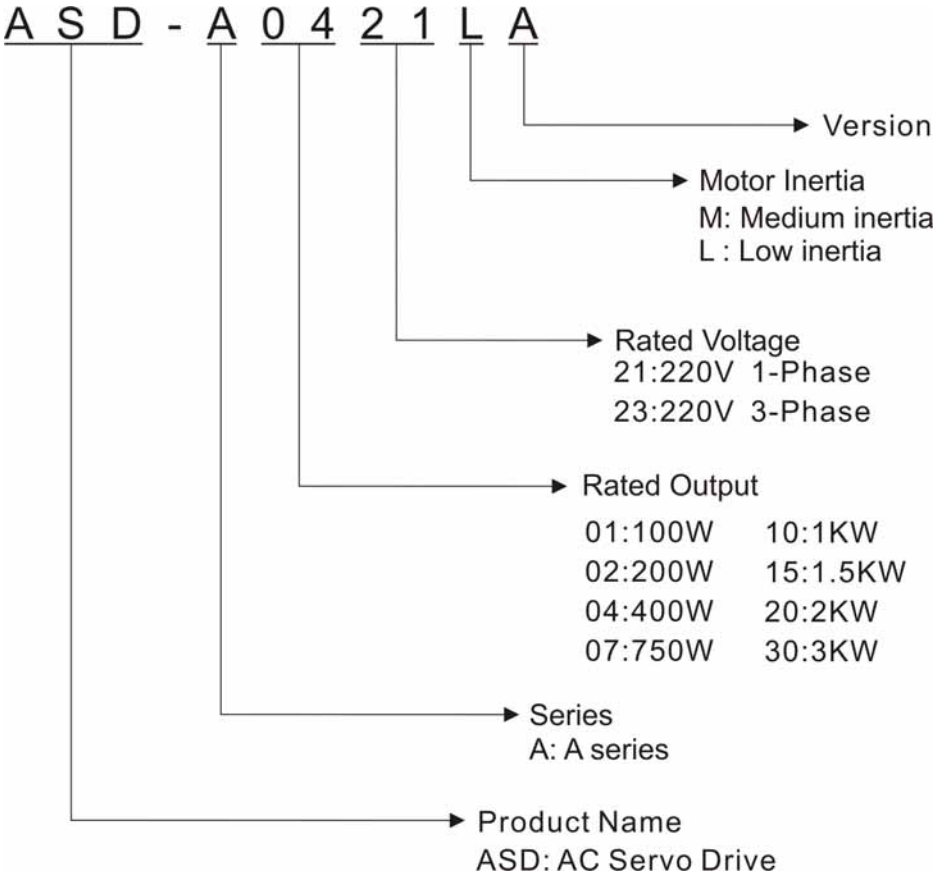


- Serial Number Explanation

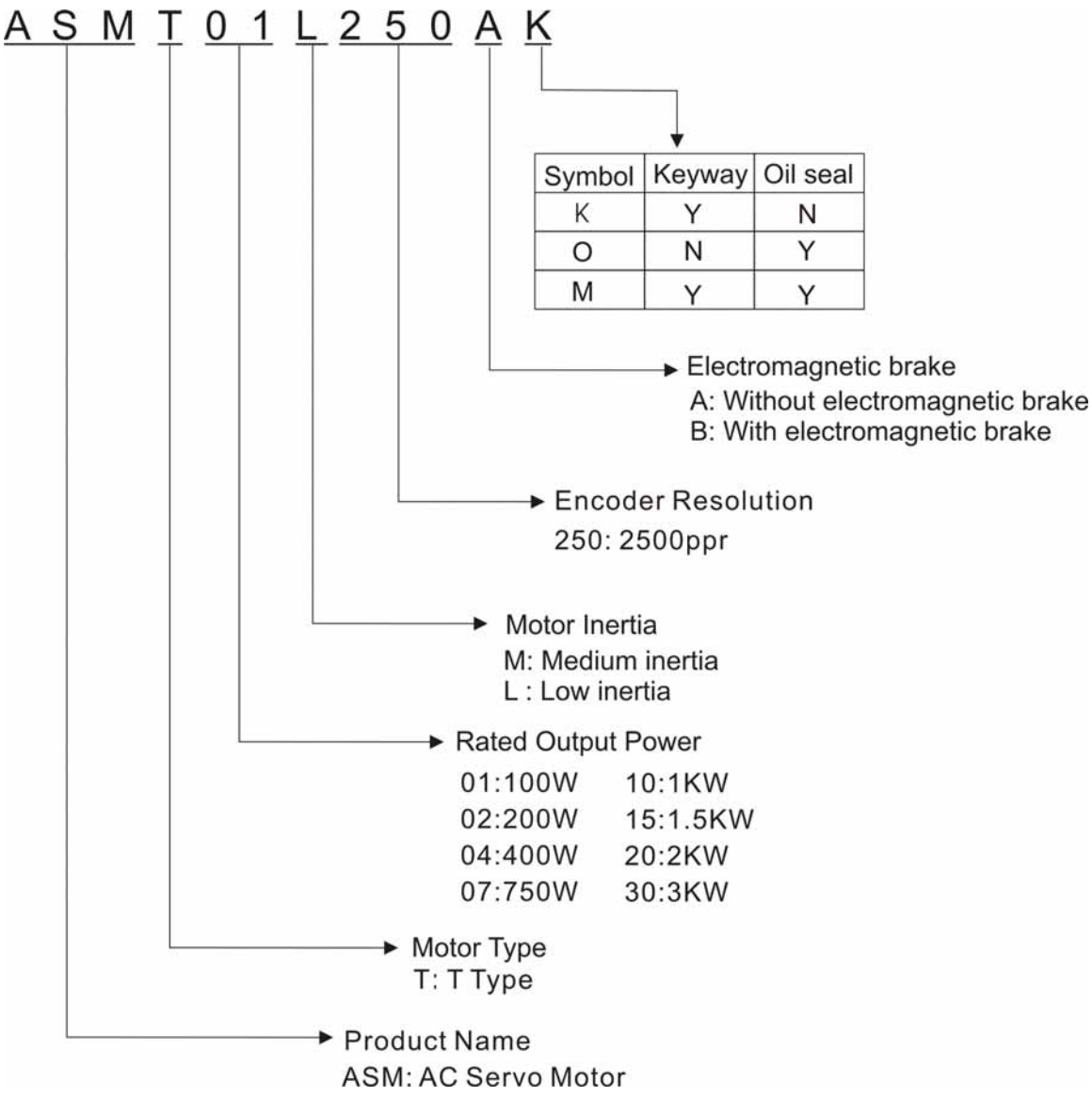


1-2-2 Model Name

ASDA-A Series Servo Drive



ASMT Series Servo Motor



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1-3 Servo Drive and Servo Motor Combinations

The tables below show the possible combination of Delta ASDA-A series servo drives and ASMT series servo motors. The boxes (☐) at the end of the model names are for version or optional configurations. (Please refer to Section 1-2 for model explanation)

		Servo drive		Servo motor	
Low inertia	100W	ASD-A0121L☐		ASMT01L250☐☐	
	200W	ASD-A0221L☐		ASMT02L250☐☐	
	400W	ASD-A0421L☐		ASMT04L250☐☐	
	750W	ASD-A0721L☐		ASMT07L250☐☐	
	1000W	ASD-A1021L☐		ASMT10L250☐☐	
	2000W	ASD-A2023L☐		ASMT20L250☐☐	
	3000W	ASD-A3023L☐		ASMT30L250☐☐	

		Servo drive		Servo motor	
Medium inertia	1000W	ASD-A1021M☐		ASMT10M250☐☐	
	1500W	ASD-A1521M☐		ASMT15M250☐☐	
	2000W	ASD-A2023M☐		ASMT20M250☐☐	
	3000W	ASD-A3023M☐		ASMT30M250☐☐	

The drives shown in the above table are designed for use in combination with the specific servo motors. Check the specifications of the drives and motors you want to use.

Also, please ensure that both the servo drive and motor are correctly matched for size (power rating).

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If the power of motor and drive is not within the specifications, the drive and motor may overheat and servo alarm would be activated. For the detail specifications of servo drives and motors, please refer to Chapter 11 “Specifications”.

The drives shown in the above table are designed according to the three multiple of rated current of motors shown in the above table. If the drives which are designed according to the six multiple of rated current of motors are needed, please contact our distributors.

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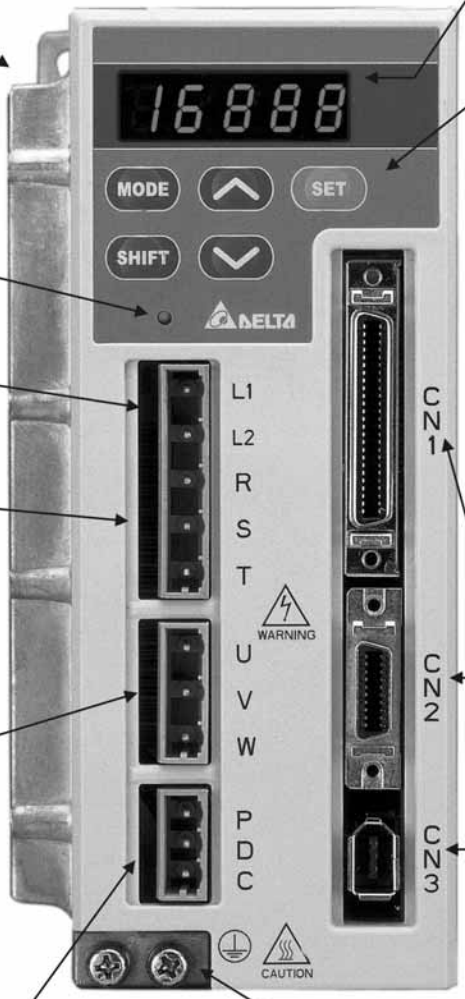
1-4 Servo Drive Features



Heatsink
Used to secure servo drive and for heat dissipation

Charge LED
A lit LED indicates that either power is connected to the servo drive OR a residual charge is present in the drive's internal power components.
DO NOT TOUCH ANY ELECTRICAL CONNECTIONS WHILE THIS LED IS LIT.
(Please refer to the Safety Precautions on page i).

Control Circuit Terminal (L1, L2)
Used to connect 200~230Vac, 50/60Hz single-phase VAC supply.

Main Circuit Terminal (R, S, T)
Used to connect 200~230V, 50/60Hz commercial power supply

Servo Motor Output (U, V, W)
Used to connect servo motor. Never connect the output terminal to main circuit power. The AC servo drive may be destroyed beyond repair if incorrect cables are connected to the output terminals.

Internal / External Regenerative Resistor Terminal
1) When using an external regenerative resistor, connect P and C to the regenerative resistor and ensure that the circuit between P and D is open.
2) When using theinternal regenerative resistor, ensure that the circuit between P and D is closed and the circuit between P and C is open.

LED Display
The 5 digit, 7 segment LED displays the servo status or fault codes

Operation Panel
Used function keys to perform status display, monitor and diagnostic, function and parameter setting.
Function Keys:
MODE : Press this key to select/change mode
SHIFT : Shift Key has several functions: moving the cursor and indexing through the parameter groups Press this key to shift cursor to the left
UP : Press this key to increase values on the display
DOWN : Press this key to decrease values on the display
SET : Press this key to store data

I/O Interface
Used to connect Host Controller (PLC) or control I/O signal

Encoder Interface
Used to connect Encoder of Servo Motor

Serial Communication Interface
For RS-485 / 232 / 422 serial communication
Used to connect personal computer or other controllers

Ground Terminal

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1-5 Control Modes of Servo Drive

The Delta Servo can be programmed to provide six single and five dual modes of operation.
Their operation and description is listed in the following table.

Mode		Code	Description
Single Mode	External Position Control	Pt	Position control for the servo motor is achieved via an external pulse command.
	Internal Position Control	Pr	Position control for the servo motor is achieved via by 8 commands stored within the servo controller. Execution of the 8 positions is via Digital Input (DI) signals.
	Speed Control	S	Speed control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command. Control of the internal speed parameters is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Internal Speed Control	Sz	Speed control for the servo motor is only achieved via parameters set within the controller. Control of the internal speed parameters is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Torque Control	T	Torque control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command. Control of the internal torque parameters is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
	Internal Torque Control	Tz	Torque control for the servo motor is only achieved via parameters set within the controller. Control of the internal torque parameters is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
Dual Mode		Pt-S	Either Pt or S control mode can be selected via the Digital Inputs (DI)
		Pt-T	Either Pt or T control mode can be selected via the Digital Inputs (DI)
		Pr-S	Either Pr or S control mode can be selected via the Digital Inputs (DI)
		Pr-T	Either Pr or T control mode can be selected via the Digital Inputs (DI)
		S-T	Either S or T control mode can be selected via the Digital Inputs (DI)

The above control modes can be accessed and changed via by parameter P1-01. If the control mode is changed, switch the drive off and on after the new control mode has been entered. The new control mode will only be valid after drive off/on action. Please see CAUTION on page iv (switching drive off/on multiple times).

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1-6 Molded-case Circuit Breaker, Fuse and Leakage Current

Model Name	OUTPUT SHORT CIRCUIT	LEAKING CURRENT	LEAKING CURRENT	BREAKER	FUSE
Operation Mode	General	3-Phase	1-Phase	General	General
ASD-A0121LA	8.4A (peak)	0.06mA	0.16mA	5A	5A
ASD-A0221LA	8.4A (peak)	0.06mA	0.16mA	5A	5A
ASD-A0421LA	25A (peak)	0.08mA	0.2mA	10A	20A
ASD-A0721LA	42A (peak)	0.08mA	0.2mA	10A	20A
ASD-A1021LA	60A (peak)	0.08mA	0.2mA	15A	25A
ASD-A1021MA	60A (peak)	0.08mA	0.2mA	15A	25A
ASD-A1521LA	66A (peak)	0.09mA	0.21mA	20A	40A
ASD-A1521MA	66A (peak)	0.09mA	0.21mA	20A	40A
ASD-A2023LA	73A (peak)	0.12mA		30A	60A
ASD-A2023MA	73A (peak)	0.12mA		30A	60A
ASD-A3023LA	107A (peak)	0.13mA		30A	80A
ASD-A3023MA	107A (peak)	0.13mA		30A	80A

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Chapter 2 Installation and Storage

2-1 Installation Notes

Pay close attention on the following installation notes:

1) Do not bend or strain the connection cables between servo drive and motor.
2) When mounting servo drive, make sure to tighten screws to secure the drive in place.
3) If the servo motor shaft is coupled directly to a rotating device ensure that the alignment specifications of the servo motor, coupling, and device are followed. Failure to do so may cause unnecessary loads or premature failure to the servo motor.
4) If the length of cable connected between servo drive and motor is more than 20m, please increase the wire gauge of the encoder cable and motor connection cable (connected to U, V, W terminals).
5) Make sure to tighten the screws for securing motor.

2-2 Storage Conditions

The product should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC drive should be stored properly when it is not to be used for an extended period of time. Some storage suggestions are:

- Store in a clean and dry location free from direct sunlight.
- Store within an ambient temperature range of -20°C to +65°C (-4°F to 149°F).
- Store within a relative humidity range of 0% to 95% and non-condensing.
- Do not store in a place subjected to corrosive gases and liquids.
- Correctly packaged and placed on a solid surface.

2-3 Installation Conditions

Operating Temperature

ASDA-A Series Servo Drive : 0°C to 55°C (32°F to 131°F)

ASMT Series Servo Motor : 0°C to 40°C (32°F to 104°F)

The ambient temperature of servo drive for long-term reliability should be under 45°C (113°F).

If the ambient temperature of servo drive is greater than 45°C (113°F), please install the drive in a well-ventilated location and do not obstruct the airflow for the cooling fan.

Caution

The servo drive and motor will generate heat. If they are installed in a control panel, please ensure sufficient space around the units for heat dissipation.

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Pay particular attention to vibration of the units and check if the vibration has impacted the electric devices in the control panel. Please observe the following precautions when selecting a mounting location. ***Failure to observe the following precautions may void the warranty!***

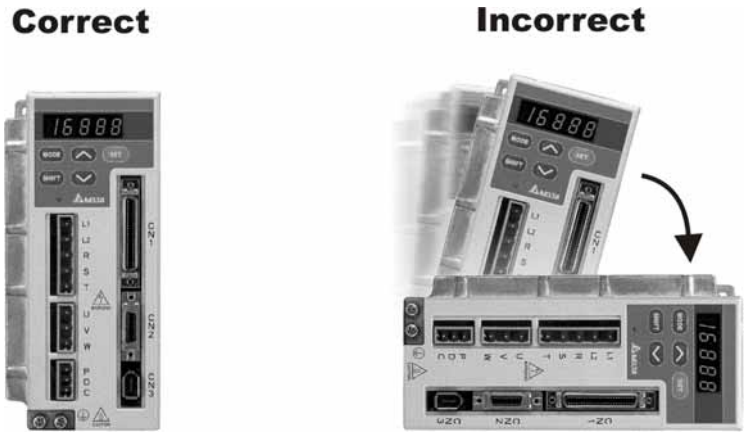
- Do not mount the servo drive or motor adjacent to heat-radiating elements or in direct sunlight.
- Do not mount the servo drive or motor in a location subjected to corrosive gases, liquids, or airborne dust or metallic particles.
- Do not mount the servo drive or motor in a location where temperatures and humidity will exceed specification.
- Do not mount the servo drive or motor in a location where vibration and shock will exceed specification.
- Do not mount the servo drive or motor in a location where it will be subjected to high levels of electromagnetic radiation.

2-4 Installation Procedure and Minimum Clearances

Installation Procedure

Incorrect installation may result in a drive malfunction or premature failure of the drive and or motor. Please follow the guidelines in this manual when installing the servo drive and motor.

The AC servo drive should be mounted perpendicular to the wall or in the control panel. In order to ensure the drive is well ventilated, ensure that the all ventilation holes are not obstructed and sufficient free space is given to the servo drive. Do not install the drive in a horizontal position or malfunction and damage will occur.



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Drive Mounting

Servo drives must be back mounted vertically on a dry and solid surface such as a NEMA enclosure. A minimum spacing of two inches must be maintained above and below the drive for ventilation and heat dissipation. Additional space may be necessary for wiring and cable connections. Also, as the drive conducts heat away via the mounting, the mounting plane or surface should be conductor away and not conduct heat into the drive from external sources

Motor Mounting

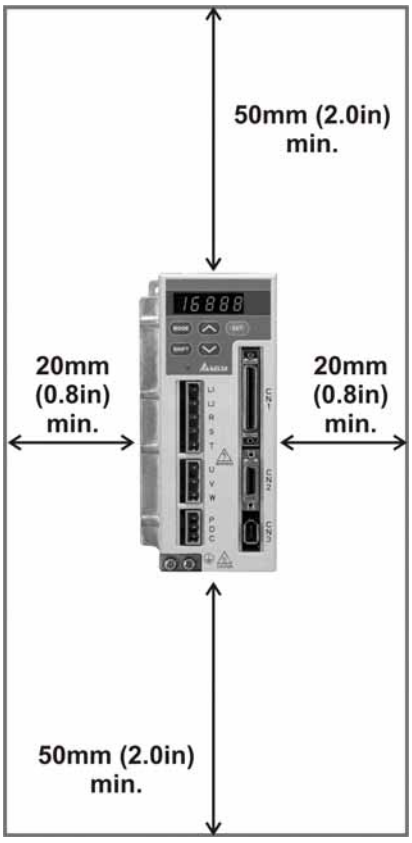
Servo motors should be mounted firmly to a dry and solid mounting surface to ensure maximum heat transfer for maximum power output and to provide a good ground.

For the dimensions and weights specifications of servo drive or motor, please refer to Chapter 11 "Specifications".

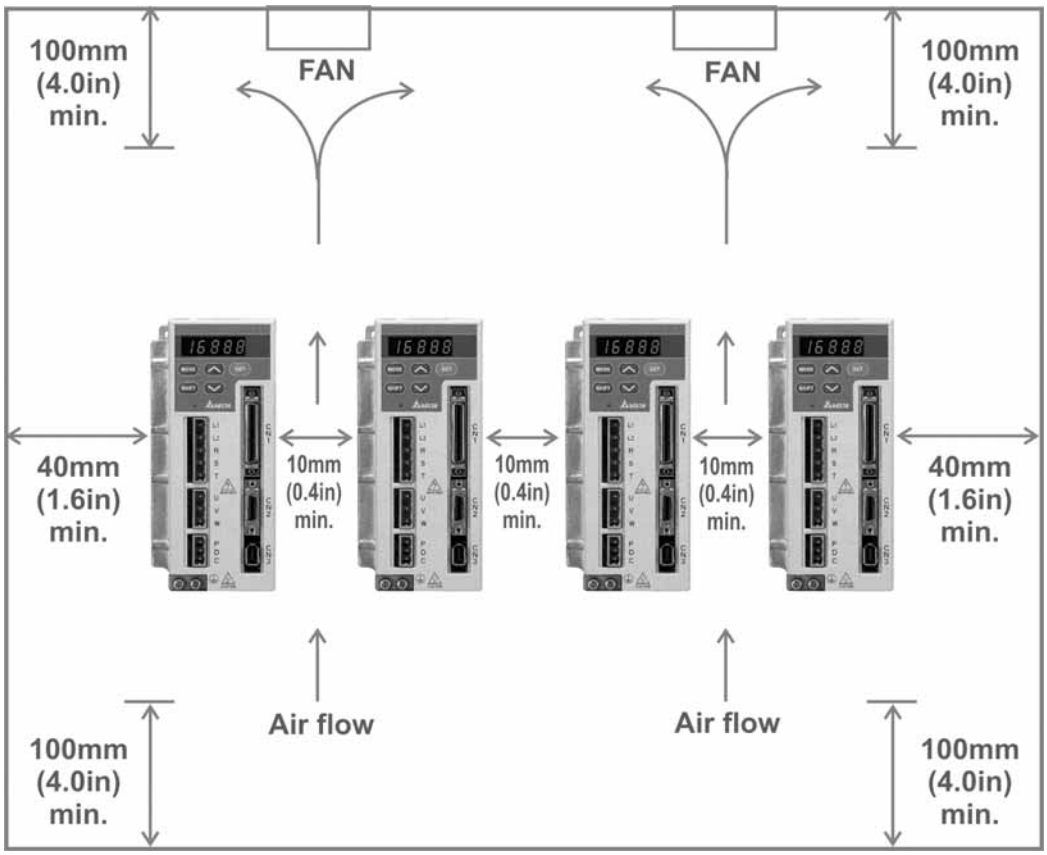
Minimum Clearances

Install a fan to increase ventilation to avoid ambient temperatures that exceed the specification. When installing two or more drive adjacent to each other please follow the clearances as shown in the following diagram.

■ **Minimum Clearances**



■ Side by Side Installation



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Chapter 3 Configuration and Wiring

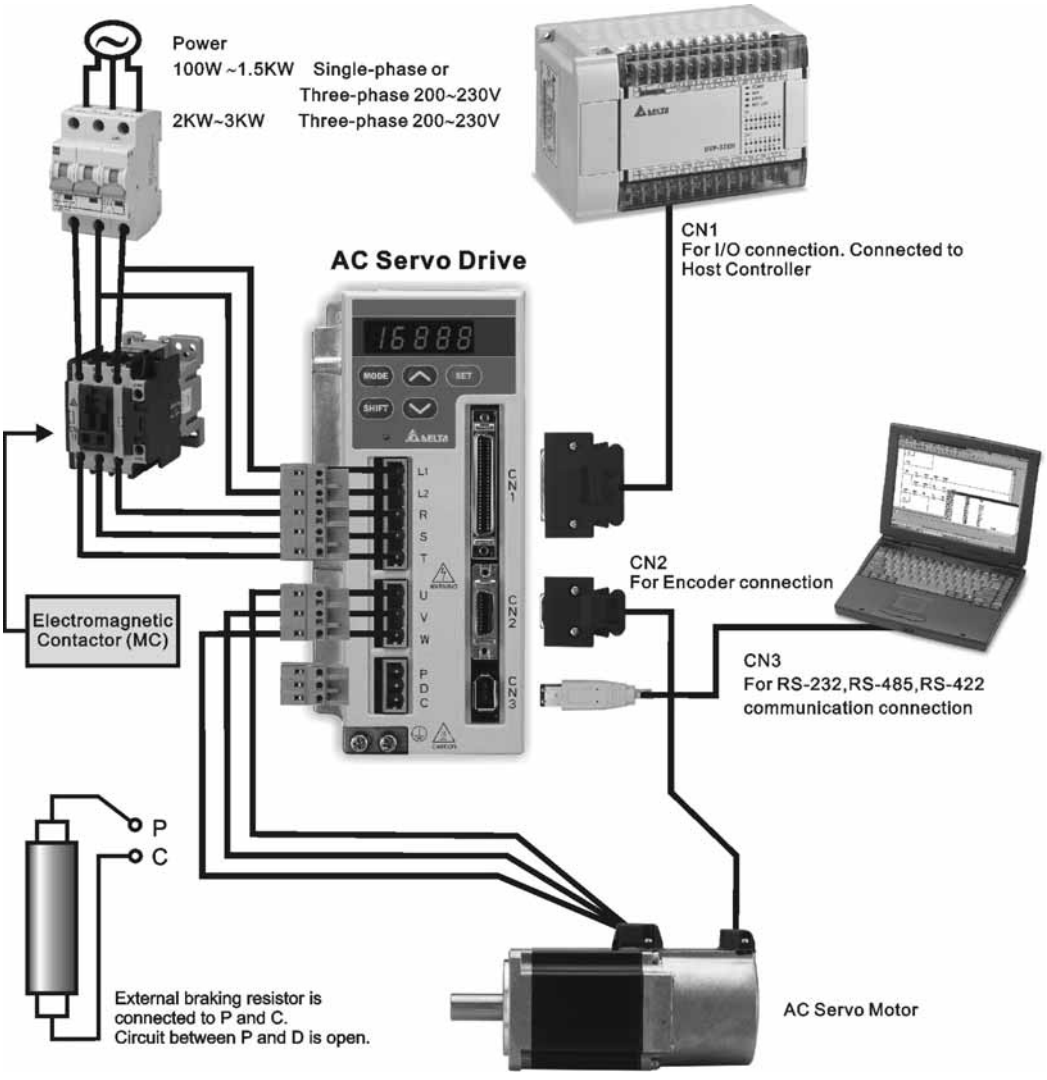
This chapter provides information on wiring ASDA-A series products, the descriptions of I/O signals and gives typical examples of wiring diagrams.

3-1 Configuration

3-1-1 Connecting to Peripheral Devices

In Figure 3.1, it briefly explains how to connect each peripheral device.

Figure 3.1



"When using an external regenerative resistor, ensure P and D is closed, and P and C is open. When using an internal regenerative resistor, connect regenerative resistor to P and C, and ensure an open circuit between P and D."

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3-1-2 Servo Drive Connectors and Terminals

<table>
<tr><th>Terminal Identification</th><th>Description</th><th>Notes</th></tr>
<tr><td>L1, L2</td><td>Control circuit terminal</td><td>The servo Control Circuit requires an independent 220V single-phase VAC supply.</td></tr>
<tr><td>R, S, T</td><td>Main circuit terminal</td><td>The Main Circuit Terminal is used to supply the servo with line power. If a single-phase supply, is used connect the R and S terminals to power. If 3-phase, connect all three R, S, & T terminals. To provide Control Circuit power two jumpers can be added from R and S to L1 and L2.</td></tr>
<tr><td>U, V, W
FG</td><td>Servo motor output</td><td>Used to connect servo motor
<table>
<tr><th>Terminal Symbol</th><th>Wire Color</th></tr>
<tr><td>U</td><td>Red</td></tr>
<tr><td>V</td><td>White</td></tr>
<tr><td>W</td><td>Black</td></tr>
<tr><td>FG</td><td>Green</td></tr>
</table></td></tr>
<tr><td rowspan="2">P, D, C</td><td rowspan="2">Regenerative resistor terminal</td><td>Internal resistor</td><td>Ensure P and D is closed, and P and C is open.</td></tr>
<tr><td>External resistor</td><td>Connect regenerative resistor to P and C, and ensure an open circuit between P and D.</td></tr>
<tr><td>⏚</td><td>Ground terminal</td><td>Used to connect grounding wire of power supply and servo motor.</td></tr>
<tr><td>CN1</td><td>I/O connector</td><td>Used to connect external controllers. Please refer to section 3-3 for details.</td></tr>
<tr><td>CN2</td><td>Encoder connector</td><td>Used to connect encoder of servo motor. Please refer to section 3-4 for details.
<table>
<tr><th>Terminal Symbol</th><th>Wire Color</th></tr>
<tr><td>A</td><td>Blue</td></tr>
<tr><td>/A</td><td>Blue/Black</td></tr>
<tr><td>B</td><td>Green</td></tr>
<tr><td>/B</td><td>Green/Black</td></tr>
<tr><td>Z</td><td>Yellow</td></tr>
<tr><td>/Z</td><td>Yellow/Black</td></tr>
<tr><td>VCC</td><td>Red</td></tr>
<tr><td>GND</td><td>Black</td></tr>
</table></td></tr>
<tr><td>CN3</td><td>Communication connector</td><td>Used to connect PC or controller. Refer to section 3-5 for details.</td></tr>
</table>

🕮 Note: U, V ,W , CN1, CN2, CN3 terminals provide short circuit protection.

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Please observe the following precautions while performing wiring and touching any electrical connections on the servo drive or servo motor.

1) Ensure to check if the power supply and wiring of the "power" terminals (R, S, T, L1, L2, U, V, & W) is correct.

2) As a residual hazardous voltage may remain inside the drive, please do not immediately touch any of the "power" terminals (R, S, T, L1, L2, U, V, & W) and/or the cables connected to them after the power has been turned off and the charge LED is lit. (Please refer to the Safety Precautions on page ii).

3) The cables connected to R, S, T and U, V, W terminals should be placed in separate conduits from the encoder or other signal cables. Separate them by at least 30cm (12").

4) For the connectors and cables specifications, please refer to section 3-1-6 for details.

3-1-3 Wiring Methods

For drives from 100W to 1kW the input power can be either single or three-phase. For drives 1.5kW and above only three-phase connections are available.

In the wiring diagram figures 3.2 & 3.3:
Power ON : contact “a” (normally open).
Power OFF or Alarm Processing : contact “b” (normally closed).
1MC/x : coil of electromagnetic contactor
1MC/a : self-holding power
1MC : contact of main circuit power.

Figure 3.2 Three-Phase Power Supply Connection

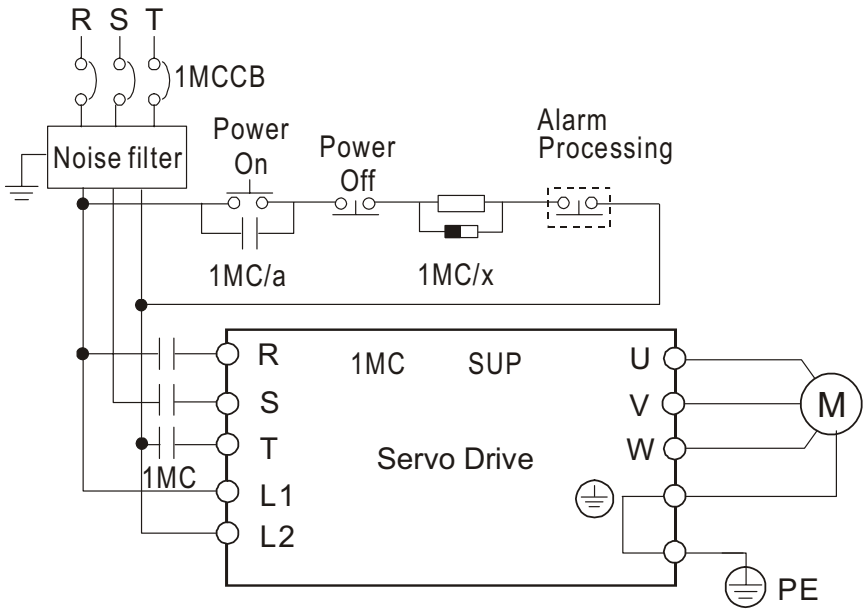
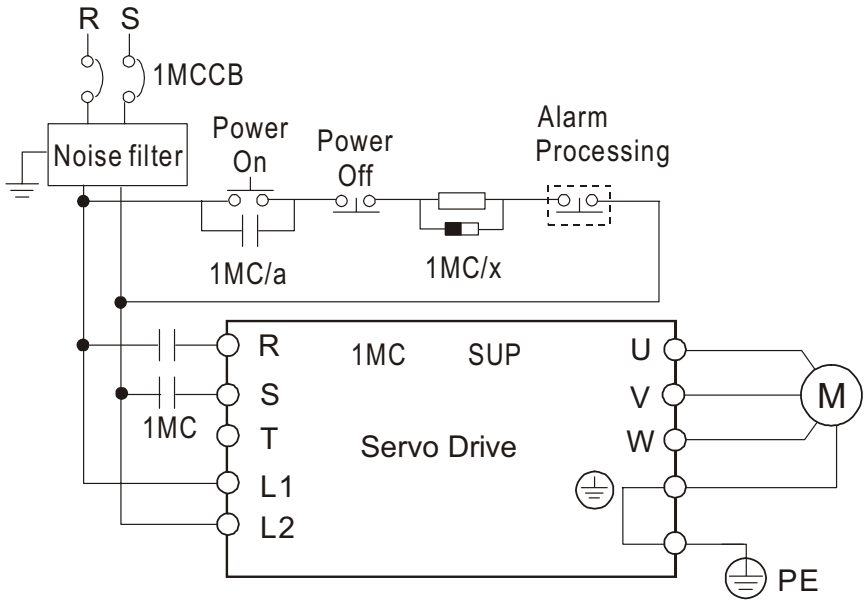
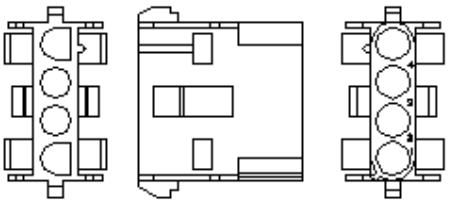
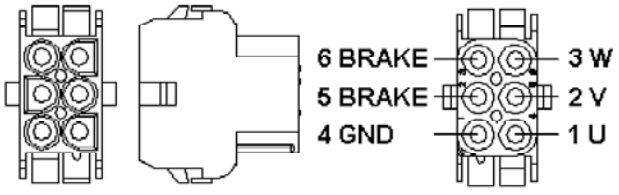


Figure 3.3 Single-Phase Power Supply Connection (for 1kW and below)



3-1-4 Motor Power Cable Connector Specifications

The boxes (☐) at the end of the model names are for version or optional configurations. (Please refer to section 1-2 for model explanation.)

Servo Drive Power Rating	Motor Part Number Description	U, V, W / Electromagnetic Brake Connector	Terminal Identification
100W	ASMT01L250A☐		A
200W	ASMT02L250A☐		
400W	ASMT04L250A☐		
750W	ASMT07L250A☐		
100W	ASMT01L250B☐		B
200W	ASMT02L250B☐		
400W	ASMT04L250B☐		
750W	ASMT07L250B☐		

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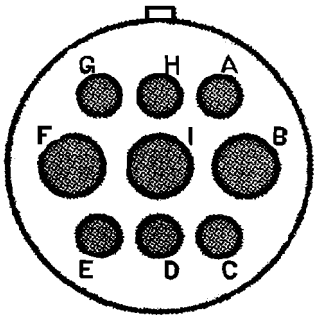
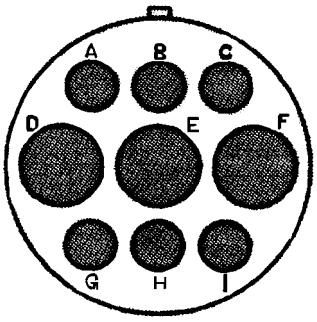
Servo Drive Power Rating	Motor Part Number Description	U, V, W / Electromagnetic Brake Connector	Terminal Identification
1kW	ASMT10L250□□ ASMT10M250□□	 20-18	C
1.5kW	ASMT15M250□□		
2kW	ASMT20L250□□		
3kW	ASMT30L250□□		
2kW	ASMT20M250□□	 24-11	D
3kW	ASMT30M250□□		

Terminal Identification	W (Black)	V (White)	U (Red)	CASE GROUND (Green)	BRAKE1 (Orange)	BRAKE2 (Yellow)
A	A3	A2	A1	A4	-	-
B	1	2	3	4	6	5
C	B	I	F	E	G	H
D	F	E	D	G	A	B

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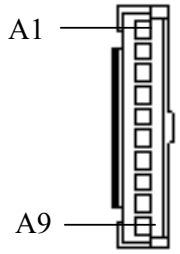
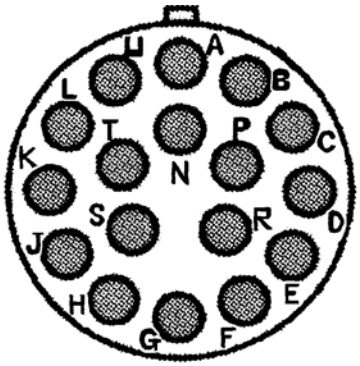
3-1-5 Encoder Connector Specifications

The boxes (☐) at the end of the model names are for version or optional configurations. (Please refer to section 1-2 for model explanation.)

Servo Drive Capacity	Motor Model Name	Encoder Connector	Terminal Identification
100W	ASMT01L250☐☐		A
200W	ASMT02L250☐☐		
400W	ASMT04L250☐☐		
750W	ASMT07L250☐☐		
1kW	ASMT10L250☐☐ ASMT10M250☐☐		B
1.5kW	ASMT15M250☐☐		
2kW	ASMT20L250☐☐ ASMT20M250☐☐		
3kW	ASMT30L250☐☐ ASMT30M250☐☐	**20-29** **17-#16**	

Terminal Identification	A (Blue)	/A (Blue/Black)	B (Green)	/B (Green/Black)	Z (Yellow)	/Z (Yellow/Black)	5V (Red)	GND (Black)	BRAID SHELD
A	A1	A2	A3	A4	A5	A6	A7	A8	A9
B	A	B	C	D	F	G	S	R	-

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3-1-6 Cable Specifications for Servo Drive

The boxes (☐) at the end of the model names are for version or optional configurations. (Please refer to section 1-2 for model explanation.)

Power Cable

Servo Drive	Power ~ mm^2 (Gauge)			
	L1, L2	R, S, T	U, V, W	P, C
ASD-A0121L☐	1.25(AWG16)	2(AWG14)	2(AWG16)	2(AWG14)
ASD-A0221 L☐	1.25(AWG16)	2(AWG14)	2(AWG16)	2(AWG14)
ASD-A0421 L☐	1.25(AWG16)	2(AWG14)	2(AWG16)	2(AWG14)
ASD-A0721 L☐	1.25(AWG16)	2(AWG14)	2(AWG16)	2(AWG14)
ASD-A1021 L☐	1.25(AWG16)	2(AWG14)	2(AWG12)	2(AWG14)
ASD-A1021M☐	1.25(AWG16)	2(AWG14)	2(AWG12)	2(AWG14)
ASD-A1521M☐	1.25(AWG16)	2(AWG14)	2(AWG12)	2(AWG14)
ASD-A2023 L☐	1.25(AWG16)	2(AWG14)	2(AWG12)	2(AWG14)
ASD-A2023 M☐	1.25(AWG16)	2(AWG14)	2(AWG12)	2(AWG14)
ASD-A3023 L☐	1.25(AWG16)	3.5(AWG12)	3.5(AWG10)	2(AWG14)
ASD-A3023 M☐	1.25(AWG16)	3.5(AWG12)	3.5(AWG10)	2(AWG14)

Encoder Cable

Servo Drive	Encoder ~ mm^2 (Gauge)			
	Wire Size	Core Number	UL Rating	Wire Length
ASD-A0121L☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A0221 L☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A0421 L☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A0721 L☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A1021 L☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A1021M☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A1521M☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A2023 L☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A2023 M☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A3023 L☐	(AWG26)	10 core (4 pair)	UL2464	3m
ASD-A3023 M☐	(AWG26)	10 core (4 pair)	UL2464	3m

🕮 Note:

1. Please use shielded twisted-pair cables for wiring to prevent voltage coupling and eliminate electrical noise and interference.
2. If the encoder cable is too short, please use a twisted-shield signal wire with grounding conductor. The wire length should be 20m or less. For lengths greater than 20m, the wire gauge should be doubled in order to lessen any signal attenuation.

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3. As for motor cable selection, please use the 600V PTFE wire and the wire length should be less than 30m. If the wiring distance is longer than 30m, please choose the adequate wire size according to the voltage.
4. The shield of shielded twisted-pair cables should be connected to the SHIELD end (terminal marked ⏚) of the servo drive.

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3-2 Basic Wiring

Figure 3.4 Basic Wiring Schematic of 100W ~ 1.5kW Models

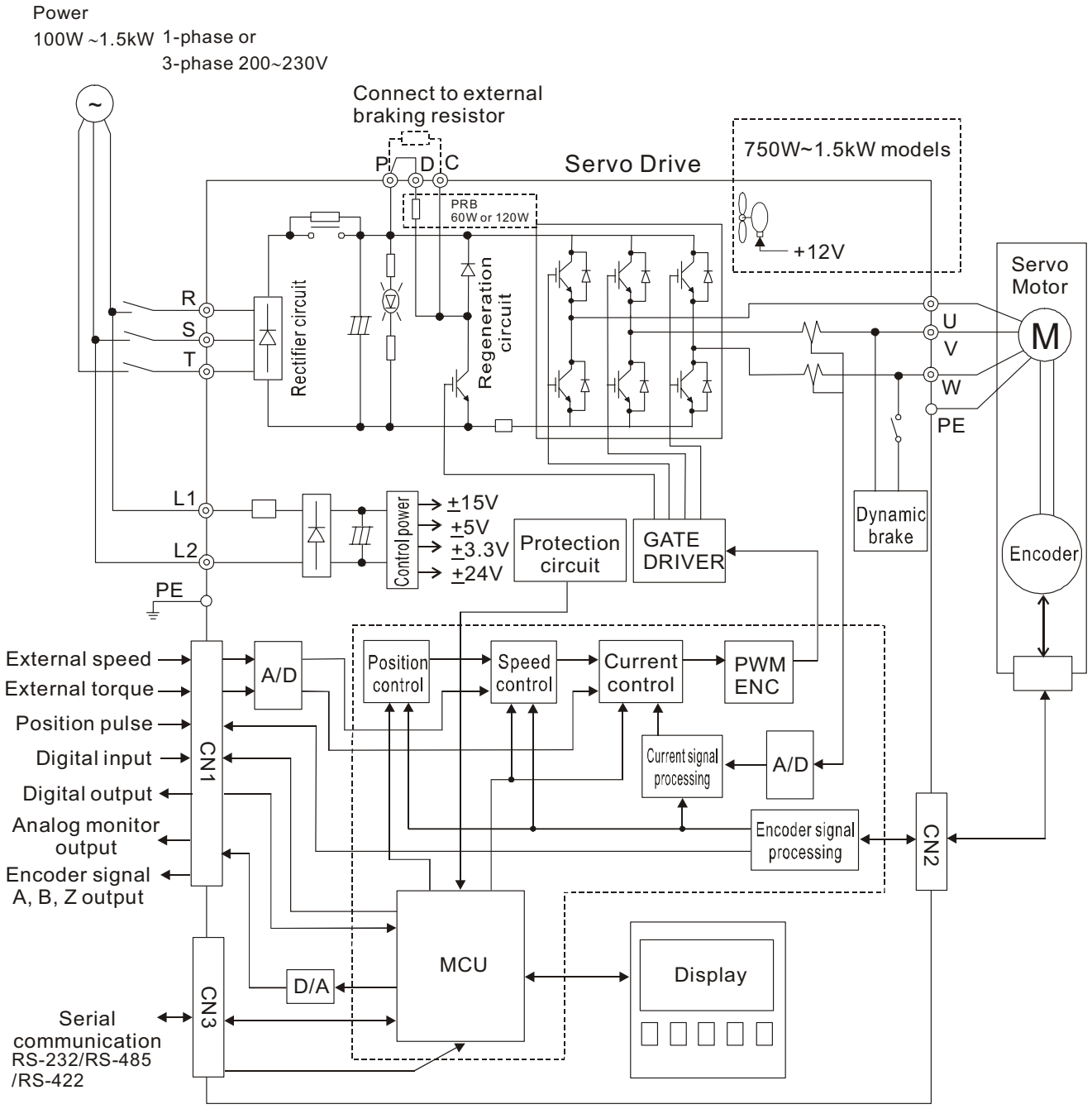
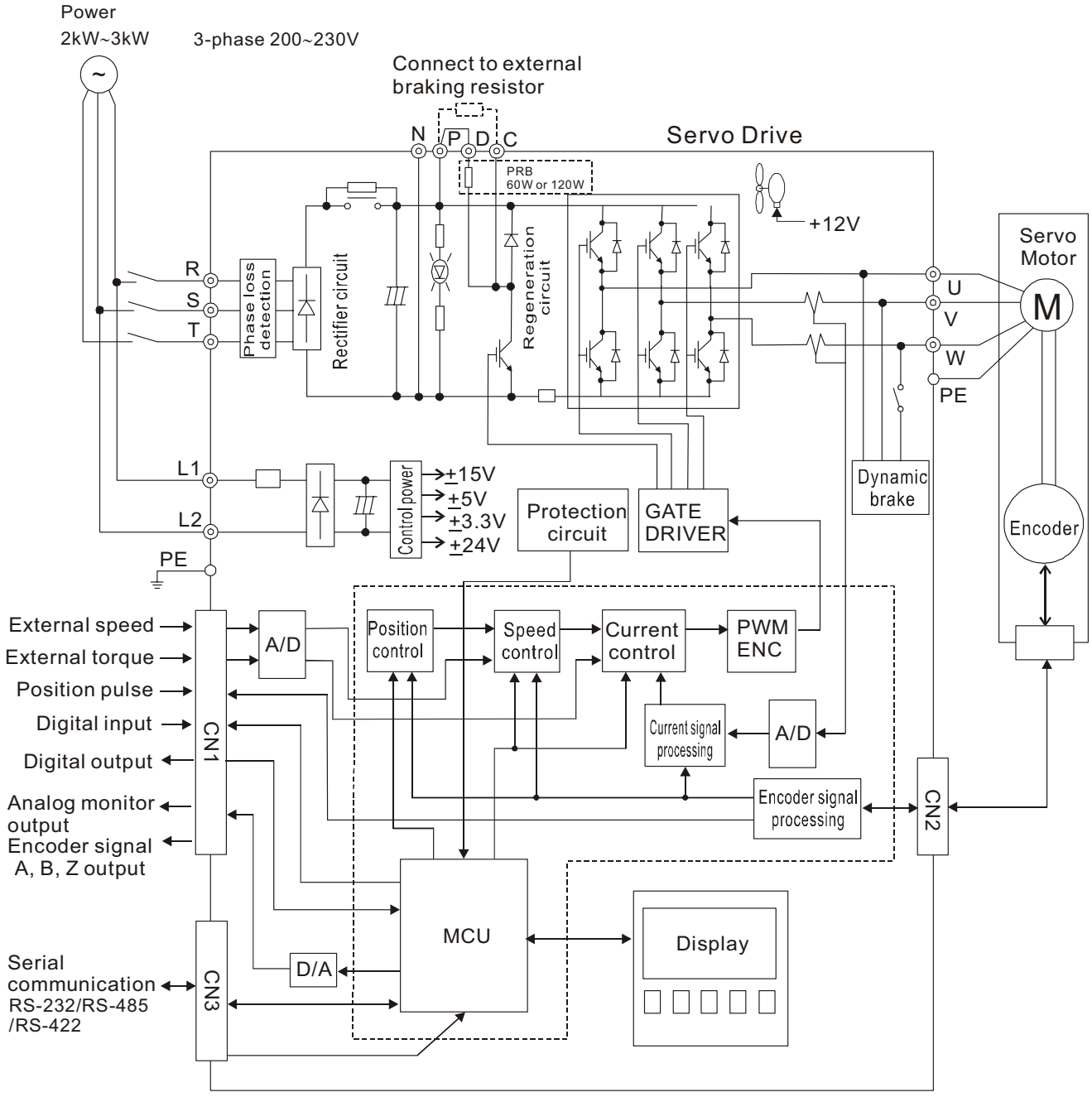


Figure 3.5 Basic Wiring Schematic of 2kW ~ 3kW Models



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3-3 Input / Output Interface Connector -CN1

The CN1 Interface Connector provides access to three signal groups:

i General interface for the analog speed and torque control, encoder reference signal from the motor, pulse / direction inputs, and reference voltages.
ii 8 programmable Digital Inputs (DI)
iii 5 programmable Digital Outputs (DO)

A detailed explanation of each group is available in section 3-3-2, tables 3-B, 3-C & 3-D.

3-3-1 CN1 Terminal Identification

Figure 3.6 shows the layout of CN1 connector:

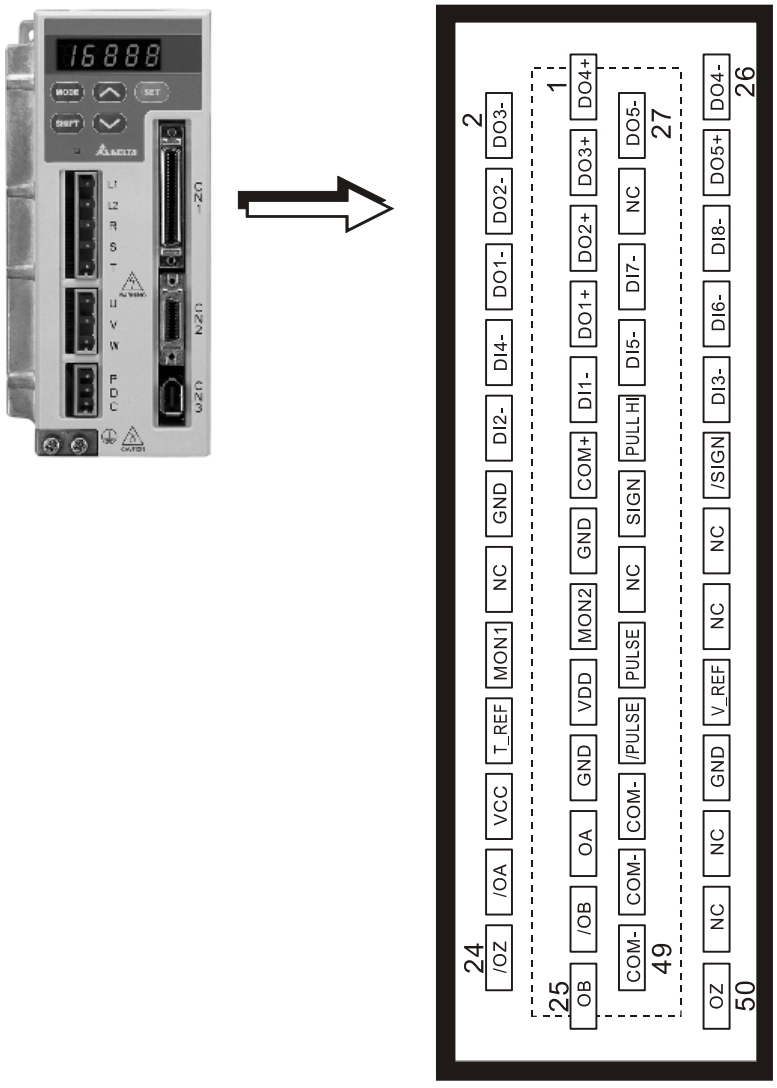

Figure 3.6

Table 3.A CN1 Terminal Identification

2	DO3-	Digital output
4	DO2-	Digital output
6	DO1-	Digital output
8	DI4-	Digital input
10	DI2-	Digital input
12	GND	Analog input signal ground
14	NC	No Connection
16	MON1	Analog monitor output 1
18	T_REF	Analog torque Input
20	VCC	+12V power output (for analog command)
22	/OA	Encoder /A pulse output
24	/OZ	Encoder /Z pulse output

1	DO4+	Digital output
3	DO3+	Digital output
5	DO2+	Digital output
7	DO1+	Digital output
9	DI1-	Digital input
11	COM+	Power input (12~24V)
13	GND	Analog input signal ground
15	MON2	Analog monitor output 2
17	VDD	+24V power output (for external I/O)
19	GND	Analog input signal ground
21	OA	Encoder A pulse output
23	/OB	Encoder /B pulse output
25	OB	Encoder B pulse output

27	DO5-	Digital output
29	NC	No Connection
31	DI7-	Digital input
33	DI5-	Digital input
35	PULL HI	Pulse applied power
37	SIGN	Position sign (+)
39	NC	No Connection
41	PULSE	Pulse input (+)
43	/PULSE	Pulse input (−)
45	COM-	VDD(24V) power ground
47	COM-	VDD(24V) power ground
49	COM-	VDD(24V) power ground

26	DO4-	Digital output
28	DO5+	Digital output
30	DI8-	Digital input
32	DI6-	Digital input
34	DI3-	Digital input
36	/SIGN	Position sign (−)
38	NC	No Connection
40	NC	No Connection
42	V_REF	Analog speed input (+)
44	GND	Analog input signal ground
46	NC	No Connection
48	NC	No Connection
50	OZ	Encoder Z pulse output

🕮 **Note:** The terminals marked "NC" must be left unconnected (No Connection). The NC terminals are used within the servo drive. Any outside connection to the NC terminals will result in damage to the drive and void the warranty!

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3-3-2 Signals Explanation of Connector CN1

The tables 3.B, 3.C, & 3.D detail the three groups of signals of the CN1 interface. Table 3.B details the general signals. Table 3.C details the Digital Input (DI) signals and Table 3.D details the Digital Output (DO) signals. The General Signals are set by the factory and can not be changed, reprogrammed or adjusted. Both the Digital Input and Digital Output signals can be programmed by the user.

Table 3.B General Signals

Signal		Pin No	Details	Wiring Diagram (Refer to 3-3-3)
Analog Signal Input	V_REF	42	Motor speed command: -10V to +10V, corresponds to the maximum speed programmed P1-55 Maximum Speed Limit (Factory default 3000 RPM).	C1
	T_REF	18	Motor torque command: -10V to +10V, corresponds to -100% to +100% rated torque command.	C1
Analog Monitor Output	MON1 MON2	16 15	The MON1 and MON2 can be assigned drive and motor parameters that can be monitored via an analogue voltage. Please reference parameter P0-03 for monitoring commands and P1-04 / P1-05 for scaling factors. Output voltage is reference to the power ground.	C2
Position Pulse Input	PULSE /PULSE SIGN /SIGN	41 43 37 36	The drive can accept two different types of pulse inputs: Open Collector and Line Driver. Three different pulse commands can be selected via parameter P1-00. Quadrature, CW + CCW pulse & Pulse / Direction.	C3/C4
	PULL HI	35	Should an Open Collector type of pulse be used this terminal must be lulled high to pin 17.	C3
Position Pulse Output	OA /OA	21 22	The motor encoder signals are available through these terminals. The encoder output pulse count can be set via parameter P1-46.	C11/C12
	OB /OB	25 23		
	OZ /OZ	50 24		

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Signal		Pin No	Details	Wiring Diagram (Refer to 3-3-3)
Power	VDD	17	VDD is the +24V source voltage provided by the drive. Maximum permissible current 500mA.	-
	COM+ COM-	11 45 47 49	COM+ is the common voltage rail of the Digital Input and Digital Output signals. Connect VDD to Com+ for source mode. For external applied power sink mode (+12V to +24V), the positive terminal should be connected to COM+ and the negative to COM-.	
Power	VCC	20	VCC is a +12V power rail provided by the drive. It can be used for the input on an analog speed or torque command. Maximum permissible current 100mA.	-
	GND	12,13, 19,44	The polarity of VCC is with respect to Ground (GND).	
Other	NC	14,29, 38,39, 40,46, 48	See previous note for NC terminals CN1 connector 3.A.	-

The Digital Input (DI) and Digital Output (DO) have factory default settings which correspond to the various servo drive control modes. (See section 1-5). However, both the DI's and DO's can be programmed independently to meet the requirements of the user.
Detailed in tables 3.C and 3.D are the DI and DO functions with their corresponding signal name and wiring schematic. The factory default settings of the DI and DO signals are detailed in tables 3.H and 3.I

All of the Digital Outputs, 1 ~ 5 and their corresponding pin numbers are factory set and nonchangeable, however, all of the assigned signals and control modes are user changeable. For Example; The alarm setting DO 5 (pins 28/27) can be assigned to DO 1 (pins 7/6) and vise versa.

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The following tables 3.C and 3.D detail the functions, applicable operational modes, signal name and relevant wiring schematic of the default DI and DO signals.

Table 3.C Digital Output Functions

DO Signal	DO Code	Assigned Control Mode	Pin No. (Default)		Details (*1)	Wiring Diagram (Refer to 3-3-3)
			+	-		
SRDY	01	ALL	7	6	SRDY is activated when the servo drive is ready to run. All fault and alarm conditions, if present, have been cleared.	C5/C6/C7/C8
SON	02	Not assigned	-	-	SON is activated when control power is applied the servo drive. The drive may or may not be ready to run as a fault / alarm condition may exist. Servo ON (SON) is "ON" with control power applied to the servo drive, there may be a fault condition or not. The servo is not ready to run. Servo ready (SRDY) is "ON" where the servo is ready to run, NO fault / alarm exists. (P2-51 should turn servo ready SRDY off / on)	
ZSPD	03	ALL	5	4	ZSPD is activated when the drive senses the motor is equal to or below the Zero Speed Range setting as defined in parameter P1-38. For Example, at default ZSPD will be activated when the drive detects the motor rotating at speed at or below 10 rpm. ZSPD will remain activated until the motor speed increases above 10 RPM.	
TSPD	04	ALL	3	2	TSPD is activated once the drive has detected the motor has reached the Target Rotation Speed setting as defined in parameter P1-39. TSPD will remain activated until the motor speed drops below the Target Rotation Speed.	

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DO Signal	DO Code	Assigned Control Mode	Pin No. (Default)		Details (*1)	Wiring Diagram (Refer to 3-3-3)
			+	-		
TPOS	05	Pt, Pr, Pt-S, Pt-T, Pr-S, Pr-T	1	26	1. When the drive is in Pt mode, TPOS will be activated when the position error is equal and below the setting value of P1-54. 2. When the drive is in Pr mode, TPOS will be activated when the drive detects that the position of the motor is in a -P1-54 to +P1-54 band of the target position. For Example, at factory default TPOS will activate once the motor is in -99 pulses range of the target position, then deactivate after it reaches +99 pulses range of the desired position.	C5/C6/C7/C8
TQL	06	Not assigned	-	-	TQL is activated when the drive has detected that the motor has reached the torques limits set by either the parameters P1-12 ~ P1-14 of via an external analog voltage.	
ALRM	07	ALL	28	27	ALRM is activated when the drive has detected a fault condition.	
BRKR	08	ALL	1	26	BRKR is activated actuation of motor brake.	
HOME	09	Pt, Pr	3	2	HOME is activated when the servo drive has detected that the "HOME" sensor (Digital Input 24) has been detected and the home conditions set in parameters P1-47, P1-50, and P1-51 have been satisfied.	
OLW	10	ALL	-	-	OLW is activated when the servo drive has detected that the motor has reached the output overload level set by parameter P1-56.	

Footnote *1: The "state" of the output function may be turned ON or OFF as it will be dependant on the settings of P2-18~P2-22.

🕮 Note:

1. PINS 3 & 2 can either be TSPD or HOME dependent upon control mode selected.
2. PINS 1 & 26 are different depending on control mode either BRKR or TPOS.

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Table 3.D Digital Input Functions

DI Signal	DI Code	Assigned Control Mode	Pin No. (Default)	Details (*2)	Wiring Diagram (Refer to 3-3-3)
SON	01	ALL	9	Servo On. Switch servo to "Servo Ready". Check parameter P2-51.	C9/C10
ARST	02	ALL	33	A number of Faults (Alarms) can be cleared by activating ARST. Please see table 10-3 for applicable faults that can be cleared with the ARST command. However, please investigate Fault or Alarm if it does not clear or the fault description warrants closer inspection of the drive system.	
GAINUP	03	ALL	-	Gain switching	
CCLR	04	Pt	10	When CCLR is activated the setting is parameter P2-50 Pulse Clear Mode is executed.	
ZCLAMP	05	ALL	-	When this signal is On and the motor speed value is lower than the setting value of P1-38, it is used to lock the motor in the instant position while ZCLAMP is On.	
CMDINV	06	Pr, T, S	-	When this signal is On, the motor is in reverse rotation.	
HOLD	07	Not assigned		Internal position control command pause	
CTRG	08	Pr, Pr-S, Pr-T	10	When the drive is in Pr mode and CTRG is activated, the drive will command the motor to move the stored position which correspond the POS 0, POS 1, POS 2 settings. Activation is triggered on the rising edge of the pulse.	
TRQLM	09	S, Sz	10	ON indicates the torque limit command is valid.	
SPDLM	10	T, Tz	10	ON indicates the speed limit command is valid.	
POS0	11	Pr, Pr-S, Pr-T	34	When the Pr Control Mode is selected the 8 stored positions are programmed via a combination of the POS 0, POS 1, and POS 2 commands. See table 3.E.	
POS1	12		8		
POS2	13		-		
SPD0	14	S, Sz, Pt-S, Pr-S, S-T	34	Select the source of speed command: See table 3.F.	
SPD1	15		8		
TCM0	16	Pt, T, Tz, Pt-T Pr-T, S-T	34	Select the source of torque command: See table 3.G.	
TCM1	17		8		
S-P	18	Pt-S, Pr-S	31	Speed / Position mode switching OFF: Speed, ON: Position	

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DI Signal	DI Code	Assigned Control Mode	Pin No. (Default)	Details (*2)	Wiring Diagram (Refer to 3-3-3)
S-T	19	S-T	31	Speed / Torque mode switching OFF: Speed, ON: Torque	C9/C10
T-P	20	Pt-T, Pr-T	31	Torque / Position mode switching OFF: Torque, ON: Position	
EMGS	21	ALL	30	It should be contact “b” and normally ON or a fault (ALE13) will display.	
CWL	22	Pt, Pr, S, T Sz, Tz	32	Reverse inhibit limit. It should be contact “b” and normally ON or a fault (ALE14) will display.	
CCWL	23	Pt, Pr, S, T Sz, Tz	31	Forward inhibit limit. It should be contact “b” and normally ON or a fault (ALE15) will display.	
ORGP	24	Not assigned	-	When ORGP is activated, the drive will command the motor to start to search the reference “Home” sensor.	
TLLM	25	Not assigned	-	Reverse operation torque limit (Torque limit function is valid only when P1-02 is enabled)	
TRLM	26	Not assigned	-	Forward operation torque limit (Torque limit function is valid only when P1-02 is enabled)	
SHOM	27	Not assigned	-	When SHOM is activated, the drive will command the motor to move to “Home”.	
INDEX0	28	Not assigned	-	Feed step selection input 0 (bit 0)	
INDEX1	29	Not assigned	-	Feed step selection input 1 (bit 1)	
INDEX2	30	Not assigned	-	Feed step selection input 2 (bit 2)	
INDEX3	31	Not assigned	-	Feed step selection input 3 (bit 3)	
INDEX4	32	Not assigned	-	Feed step selection input 4 (bit 4)	
MD0	33	Not assigned	-	Feed step mode input 0 (bit 0)	
MD1	34	Not assigned	-	Feed step mode input 1 (bit 1)	
MDP0	35	Not assigned	-	Manually continuous operation	
MDP1	36	Not assigned	-	Manually single step operation	
JOGU	37	Not assigned	-	Forward JOG input. When JOGU is activated, the motor will JOG in forward direction. [see P4-05]	
JOGD	38	Not assigned	-	Reverse JOG input. When JOGD is activated, the motor will JOG in reverse direction. [see P4-05]	
STEPU	39	Not assigned	-	Step up input. When STEPU is activated, the motor will run to next position.	
STEPD	40	Not assigned	-	Step down input. When STEPD is activated, the motor will run to previous position.	

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DI Signal	DI Code	Assigned Control Mode	Pin No. (Default)	Details (*2)	Wiring Diagram (Refer to 3-3-3)
STEPB	41	Not assigned	-	Step back input. When STEPB is activated, the motor will return to first position.	C9/C10
AUTOR	42	Not assigned	-	Auto run input. When AUTOR is activated, the motor will run automatically according to internal position command. For time interval setting, please see P2-52 to P2-59.	
GNUM0	43	Not assigned	-	Electronic gear ratio (Numerator) selection 0 [See P2-60~P2-62]	
GNUM1	44	Not assigned	-	Electronic gear ratio (Numerator) selection 1 [See P2-60~P2-62]	
INHP	45	Not assigned	-	Pulse inhibit input. When the drive is in position mode, if INHP is activated, the external pulse input command is not valid.	

Footnote *2: The "state" of the input function may be turned ON or OFF as it will be dependant on the settings of P2-10~P2-17.

Table 3.E

POS2	POS1	POS0	Parameter
OFF	OFF	OFF	P1-15, P1-16
OFF	OFF	ON	P1-17, P1-18
OFF	ON	OFF	P1-19, P1-20
OFF	ON	ON	P1-21, P1-22
ON	OFF	OFF	P1-23, P1-24
ON	OFF	ON	P1-25, P1-26
ON	ON	OFF	P1-27, P1-28
ON	ON	ON	P1-29, P1-30

Table 3.F

SPD1	SPD0	Parameter
OFF	OFF	S mode: analog input Sz mode: 0
OFF	ON	P1-09
ON	OFF	P1-10
ON	ON	P1-11

Table 3.G

TCM1	TCM0	Parameter
OFF	OFF	T mode: analog input Tz mode: 0
OFF	ON	P1-12
ON	OFF	P1-13
ON	ON	P1-14

The default DI and DO signals in different control mode are listed in the following table 3.H and table 3.I. Although the content of the table 3.H and table 3.I do not provide more information than the table 3.C and table 3.D above, as each control mode is separated and listed in different row, it is easy for user to view and can avoid confusion. However, the Pin number of each signal can not be displayed in the table 3.H and table 3.I.

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Table 3.H Default DI signals and Control modes

Signal	DI Code	Function	Pt	Pr	S	T	Sz	Tz	Pt-S	Pt-T	Pr-S	Pr-T	S-T
SON	01	Servo On	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1	DI1
ARST	02	Reset	DI5	DI5	DI5	DI5	DI5	DI5					
GAINUP	03	Gain switching in speed and position mode											
CCLR	04	Pulse clear (see P2-50)	DI2						DI2	DI2			
ZCLAMP	05	Low speed CLAMP											
CMDINV	06	Command input reverse control											
HOLD	07	Internal position control command pause											
CTRG	08	Command triggered (available in P mode only)		DI2							DI2	DI2	
TRQLM	09	Torque limit enabled			DI2		DI2						
SPDLM	10	Speed limit enabled				DI2		DI2					
POS0	11	Position command selection (1~8)		DI3							DI3	DI3	
POS1	12	Position command selection (1~8)		DI4							DI4	DI4	
POS2	13	Position command selection (1~8)											
SPD0	14	Speed command selection (1~4)			DI3		DI3		DI3		DI5		DI3
SPD1	15	Speed command selection (1~4)			DI4		DI4		DI4		DI6		DI4
TCM0	16	Torque command selection (1~4)	DI3			DI3		DI3		DI3		DI5	DI5
TCM1	17	Torque command selection (1~4)	DI4			DI4		DI4		DI4		DI6	DI6
S-P	18	Position / Speed mode switching (OFF: Speed, ON: Position)							DI7		DI7		
S-T	19	Speed / Torque mode switching (OFF: Speed, ON: Torque)											DI7
T-P	20	Torque / Position mode switching (OFF: Torque, ON: Position)								DI7		DI7	
EMGS	21	Emergency stop (contact b)	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8	DI8
CWL	22	Reverse inhibit limit (contact b)	DI6	DI6	DI6	DI6	DI6	DI6					
CCWL	23	Forward inhibit limit (contact b)	DI7	DI7	DI7	DI7	DI7	DI7					
ORGP	24	Reference “Home” sensor											

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Signal	DI Code	Function	Pt	Pr	S	T	Sz	Tz	Pt-S	Pt-T	Pr-S	Pr-T	S-T
TLLM	25	Reverse operation torque limit (torque limit function is valid only when P1-02 is enabled)											
TRLM	26	Forward operation torque limit (torque limit function is valid only when P1-02 is enabled)											
SHOM	27	Move to “Home”											
INDEX0	28	Feed step selection input 0 (bit 0)											
INDEX1	29	Feed step selection input 1 (bit 1)											
INDEX2	30	Feed step selection input 2 (bit 2)											
INDEX3	31	Feed step selection input 3 (bit 3)											
INDEX4	32	Feed step selection input 4 (bit 4)											
MD0	33	Feed step mode input 0											
MD1	34	Feed step mode input 1											
MDP0	35	Manually continuous operation											
MDP1	36	Manually single step operation											
JOGU	37	Forward JOG input											
JOGD	38	Reverse JOG input											
STEPU	39	Step up input (available in Pr mode only)											
STEPD	40	Step down input (available in Pr mode only)											
STEPB	41	Step back input. (available in internal auto running mode only)											
AUTOR	42	Auto run input											
GNUM0	43	Electronic gear ratio (Numerator) selection 0 [see P2-60~P2-62]											
GNUM1	44	Electronic gear ratio (Numerator) selection 1 [see P2-60~P2-62]											
INHP	45	Pulse inhibit input											

🕮 **Note**: For Pin numbers of DI1~DI8 signals, please refer to section 3-3-1.

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Table 3.I Default DO signals and Control modes

Signal	DO Code	Function	Pt	Pr	S	T	Sz	Tz	Pt-S	Pt-T	Pr-S	Pr-T	S-T
SRDY	01	Servo ready	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1	DO1
SON	02	Servo On											
ZSPD	03	Zero speed	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2	DO2
TSPD	04	Speed reached			DO3	DO3	DO3	DO3	DO3	DO3	DO3	DO3	DO3
TPOS	05	Positioning completed	DO4	DO4					DO4	DO4	DO4	DO4	DO4
TQL	06	Reached torques limits											
ALRM	07	Servo alarm output (Servo fault)	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5	DO5
BRKR	08	Electromagnetic brake			DO4	DO4	DO4	DO4					
HOME	09	Home completed	DO3	DO3									
OLW	10	Output overload warning											

📖 **Note**: For Pin numbers of DO1~DO5 signals, please refer to section 3-3-1.

3-3-3 User-defined DI and DO signals

If the default DI and DO signals could not be able to fulfill users' requirements, there are still user-defined DI and DO signals. The setting method is easy and they are all defined via parameters. The user-defined DI and DO signals are defined via parameters P2-10 to P2-17 and P2-18 to P2-22.

Please refer to the following Table 3.J for the settings.

Table 3.J User-defined DI and DO signals

Signal Name		Pin No.	Parameter
DI	DI1-	9	P2-10
	DI2-	10	P2-11
	DI3-	34	P2-12
	DI4-	8	P2-13
	DI5-	33	P2-14
	DI6-	32	P2-15
	DI7-	31	P2-16
	DI8-	30	P2-17

Signal Name		Pin No.	Parameter
DO	DO1+	7	P2-18
	DO1-	6	
	DO2+	5	P2-19
	DO2-	4	
	DO3+	3	P2-20
	DO3-	2	
	DO4+	1	P2-21
	DO4-	26	
	DO5+	28	P2-22
	DO5-	27	

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Setting of parameter P2-10 to P2-17:		
DI Code	Signal	Description
01	SON	Servo On
02	ARST	Reset
03	GAINUP	Gain switching in speed and position mode
04	CCLR	Pulse clear (see P2-50)
05	ZCLAMP	Low speed CLAMP
06	CMDINV	Command input reverse control
07	HOLD	Internal position control command pause
08	CTRG	Command triggered (available in P mode only)
09	TRQLM	Torque limit enabled
10	SPDLM	Speed limit enabled
11	POS0	Position command selection (1~8)
12	POS1	Position command selection (1~8)
13	POS2	Position command selection (1~8)
14	SPD0	Speed command selection (1~3)
15	SPD1	Speed command selection (1~3)
16	TCM0	Torque command selection (1~3)
17	TCM1	Torque command selection (1~3)
18	S-P	Position / Speed mode switching (OFF: Speed, ON: Position)
19	S-T	Speed / Torque mode switching (OFF: Speed, ON: Torque)
20	T-P	Torque / Position mode switching (OFF: Torque, ON: Position)
21	EMGS	Emergency stop (contact b)
22	CWL	Reverse inhibit limit (contact b)
23	CCWL	Forward inhibit limit (contact b)
24	ORGP	Reference “Home” sensor
25	TLLM	Reverse operation torque limit (Torque limit function is valid only when P1-02 is enabled)
26	TRLM	Forward operation torque limit (Torque limit function is valid only when P1-02 is enabled)
27	SHOM	Move to “Home”
28	INDEX0	Feed step selection input 0 (bit 0)
29	INDEX1	Feed step selection input 1 (bit 1)
30	INDEX2	Feed step selection input 2 (bit 2)
31	INDEX3	Feed step selection input 3 (bit 3)
32	INDEX4	Feed step selection input 4 (bit 4)

Setting of parameter P2-18 to P2-22:		
DO Code	Signal	Description
01	SRDY	Servo ready
02	SON	Servo On
03	ZSPD	Zero speed
04	TSPD	Speed reached
05	TPOS	Positioning completed
06	TQL	Reached torques limits
07	ALRM	Servo alarm output (Servo fault)
08	BRKR	Electromagnetic brake
09	HOME	Home completed
10	OLW	Output overload warning

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Setting of parameter P2-10 to P2-17:		
DI Code	**Signal**	**Description**
33	MD0	Feed step mode input 0
34	MD1	Feed step mode input 1
35	MDP0	Manually continuous operation
36	MDP1	Manually single step operation
37	JOGU	Forward JOG input
38	JOGD	Reverse JOG input
39	STEPU	Step up input (available in Pr mode only)
40	STEPD	Step down input (available in Pr mode only)
41	STEPB	Step back input. (available in internal auto running mode only)
42	AUTOR	Auto run input
43	GNUM0	Electronic gear ratio (Numerator) selection 0 [see P2-60~P2-62]
44	GNUM1	Electronic gear ratio (Numerator) selection 1 [see P2-60~P2-62]
45	INHP	Pulse inhibit input

DI signal:

For example: If user wants to set DI1 to be servo on, it only needs to set the value of parameter P2-10 to 101 (refer to chapter 7).

🕮 **Note**: 11~17: Single control mode;18~20: Dual control mode; 0: Input function disabled

DO signal:

For example: If users want to set DO1 to be servo ready, it only needs to set the value of parameter P2-18 to 101 (refer to chapter 7).

🕮 **Note**: 0: Output function disabled

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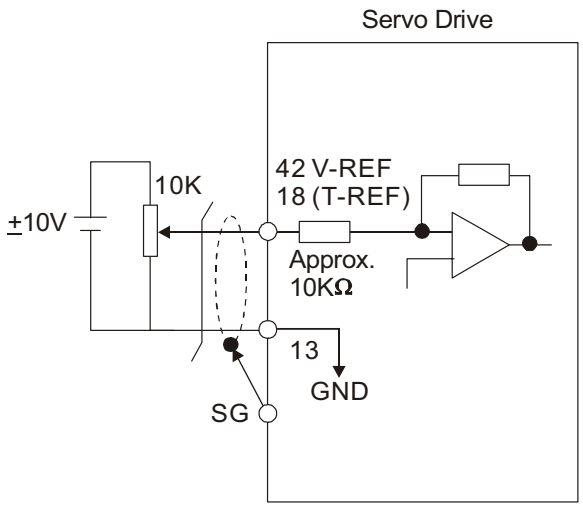
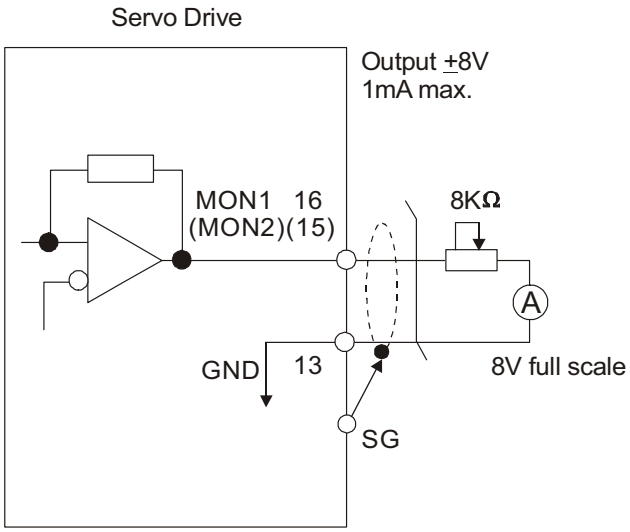
3-3-4 Wiring Diagrams of I/O Signals (CN1)

The valid voltage range of analog input command in speed and torque mode is -10V ~+10V. The command value can be set via relevant parameters.

C1: Speed / Torque analog signal input

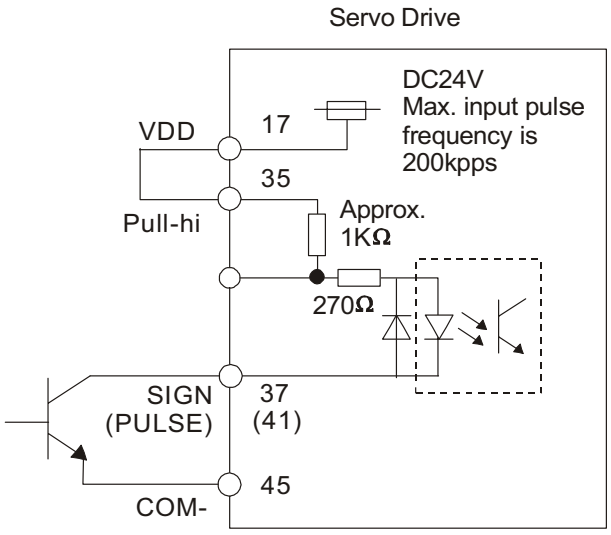


C2: Analog monitor output (MON1, MON2)

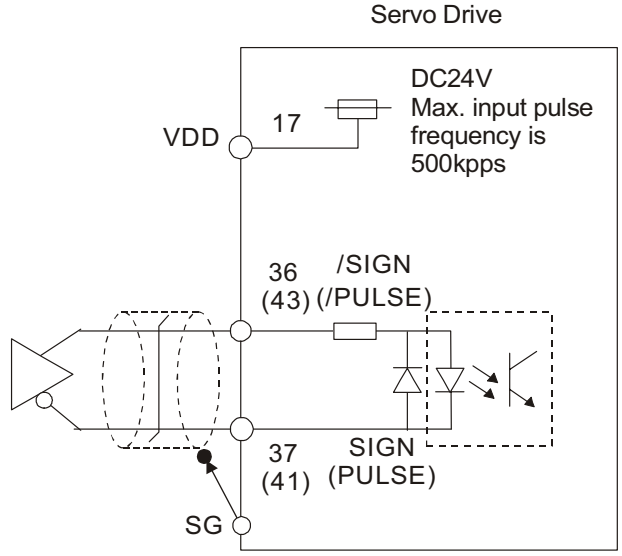


There are two kinds of pulse inputs, Line driver input and Open-collector input. Max. input pulse frequency of Line driver input is 500kpps and max. input pulse frequency of Open-collector input is 200kpps.

C3: Pulse input (Open-collector input)



C4: Pulse input (Line driver)



Be sure to connect a diode when the drive is applied to inductive load.

(Continuous maximum current: 40mA, Instantaneous peak current: max. 100mA)

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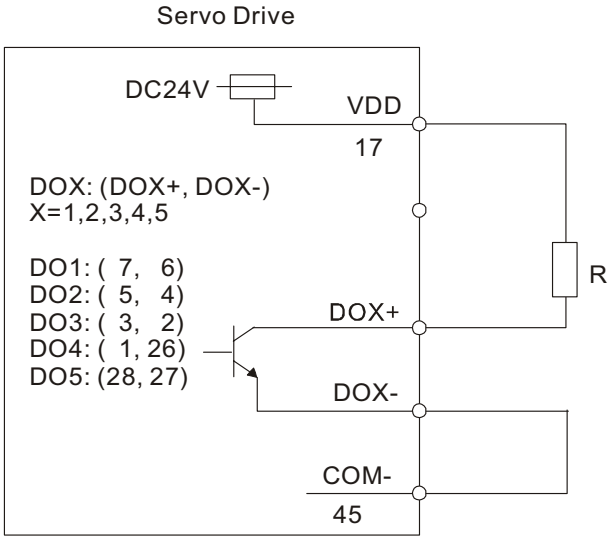
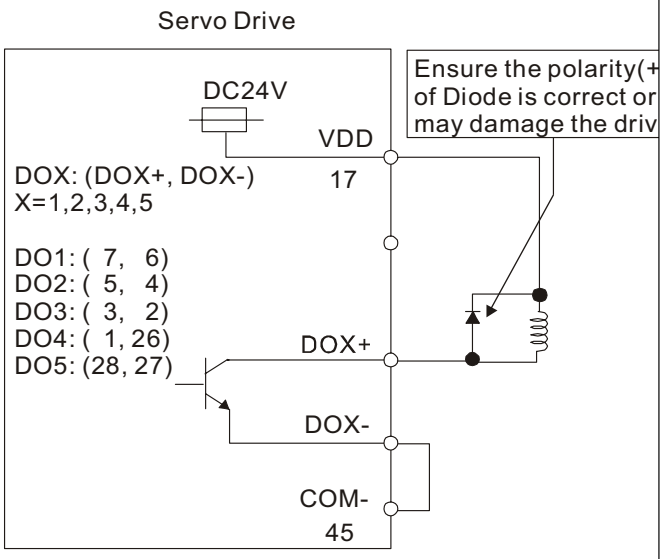
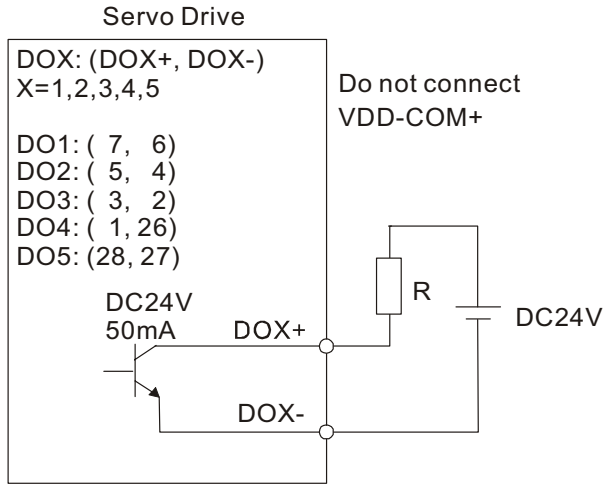
C5: Wiring of DO signal, for the use of internal power supply, general load



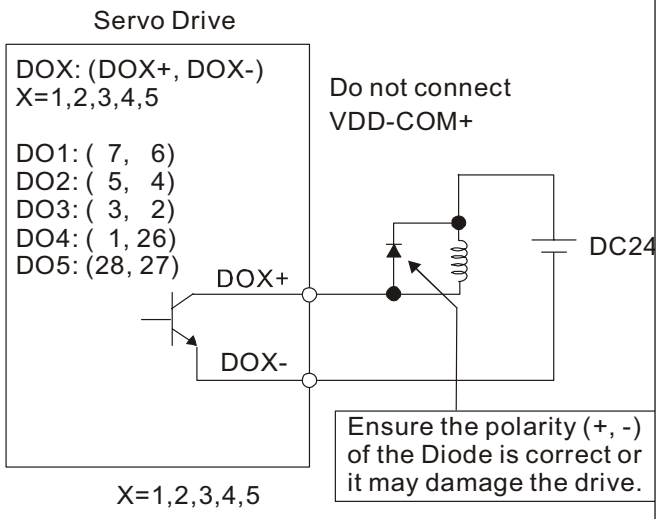
C6: Wiring of DO signal, for the use of internal power supply, inductive load



C7: Wiring of DO signal, for the use of external power supply, general load



C8: Wiring of DO signal, for the use of external power supply, inductive load



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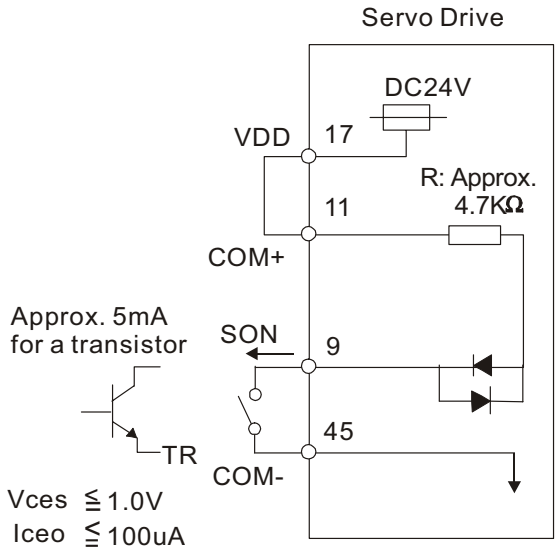
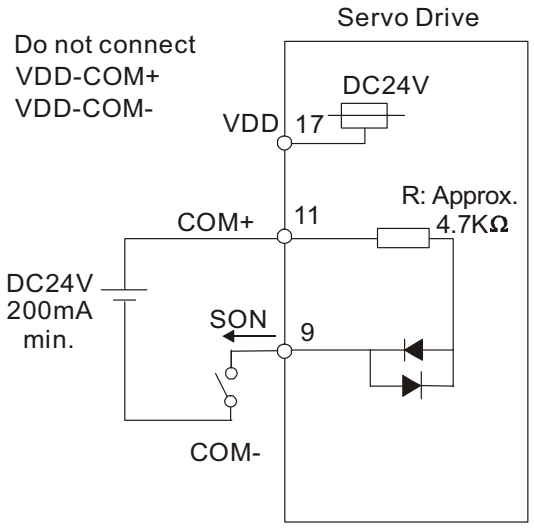
Use a relay or open-collector transistor to input signal.

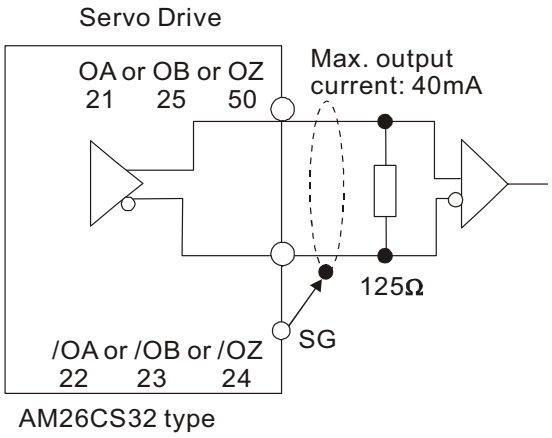
C9: Wiring of DI signal, for the use of internal power supply



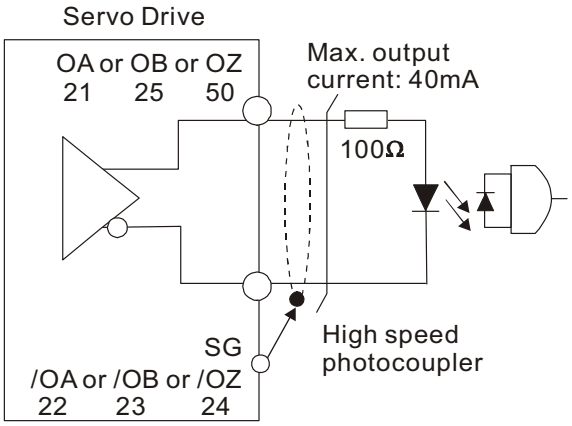
C10: Wiring of DI signal, for the use of external power supply



C11: Encoder output signal (Line driver)



C12: Encoder output signal (photocoupler)



3-4 Encoder Connector CN2

Integrated within the servo motor is a 2500PPR incremental encoder.

When power is first applied to the servo drive, control algorithms detect the motor's rotor position through imbedded sensors in the motor. Feedback to the amplifier of the UVW signals for commutation is via the ABZ encoder signal wires. Following rotor position sensing the amplifier automatically switches to encoding for commutation control.

The 2500PPR encoder is automatically multiplied to 10000PPR for increased control accuracy.

Figure 3.7 shows the layout of CN2 connector:

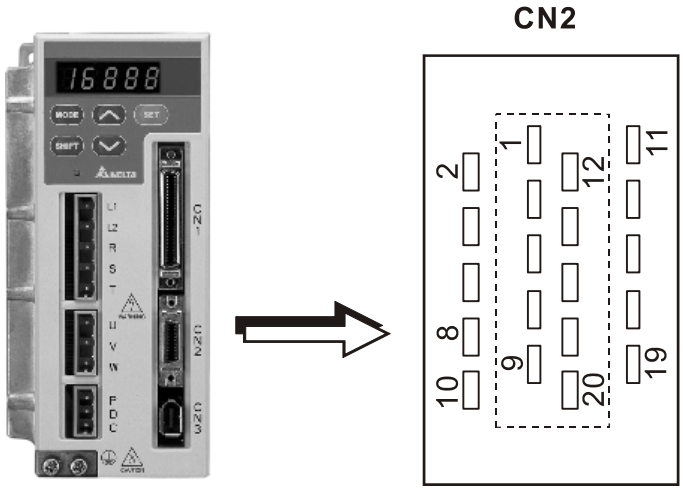


Figure 3.7

Table 3.K Signals of Encoder Connector

PIN No.	Signal Name	Terminal Identification	Military Connector	Quick Connector	Description
2	/Z phase input	/Z	G	A6	Encoder /Z phase output
4	/A phase input	/A	B	A2	Encoder /A phase output
5	A phase input	A	A	A1	Encoder A phase output
7	B phase input	B	C	A3	Encoder B phase output
9	/B phase input	/B	D	A4	Encoder /B phase output
10	Z phase input	Z	F	A5	Encoder Z phase output
14,16	Encoder power	+5V	S	A7	Encoder 5V power
13,15	Encoder power	GND	R	A8	Grounding

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3-5 Serial Communication Connector CN3

3-5-1 CN3 Terminal Layout and Identification

The servo drive can be connected to a PC or controller via a serial communication connector. Users can operate the servo drive through PC software supplied by Delta (contact to the dealer). The communication connector/port of Delta servo drive can provide three common serial communication interfaces: RS-232, RS-485, and RS-422 connection. RS-232 is mostly be used but is somewhat limited. The maximum cable length for an RS-232 connection is 15 meters (50 feet). Using RS-485 interface can allow longer distance for transmission and support multiple drives to be connected simultaneously. However, an adapter is required for converting electric current and voltage when using RS-485 interface.

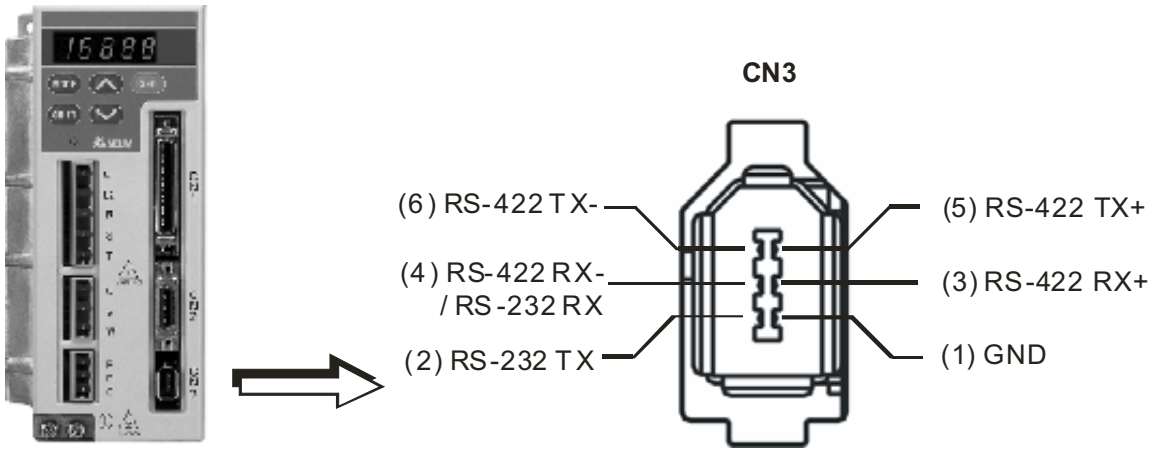

Table 3.L Signals of Serial Communication Connector

PIN No.	Signal Name	Terminal Identification	Description
1	Grounding	GND	-
2	RS-232 data transmission	RS-232-TX	For data transmission of the servo drive. Connected to the RS-232 interface of PC.
3	RS-422 data receiving	RS-422-RX+	For data receiving of the servo drive (differential line driver + end)
4	RS-232 data receiving	RS-232_RX	For data receiving of the servo drive. Connected to the RS-232 interface of PC.
	RS-422 data receiving	RS-422_RX-	For data receiving of the servo drive (differential line driver - end)
5	RS-422 data transmission	RS-422-TX+	For data transmission of the servo drive (differential line driver + end)
6	RS-422 data transmission	RS-422-TX-	For data transmission of the servo drive (differential line driver - end)

📖 **Note**: For the connection of RS-485, please refer to page 8-2 and 8-3.

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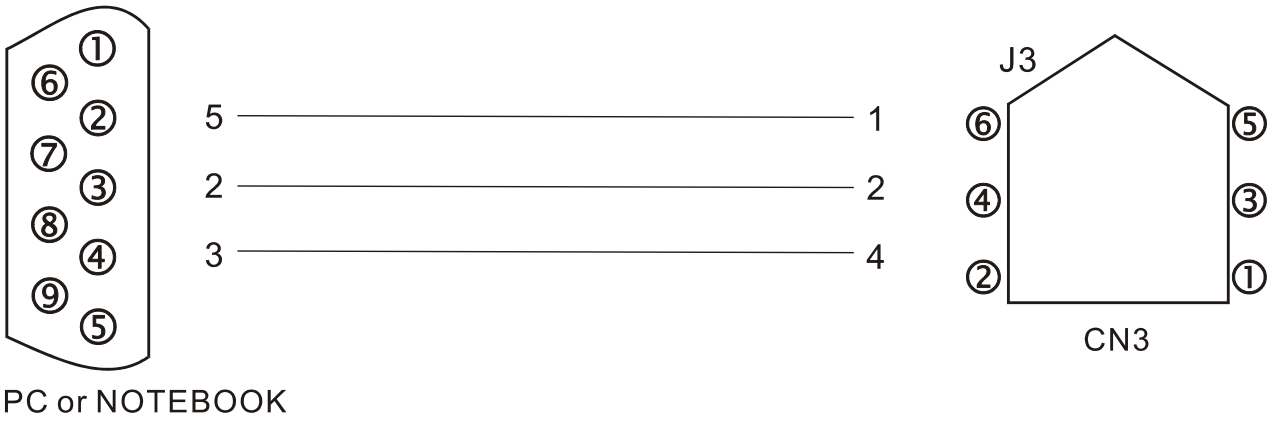
3-5-2 Connection between PC and Connector CN3



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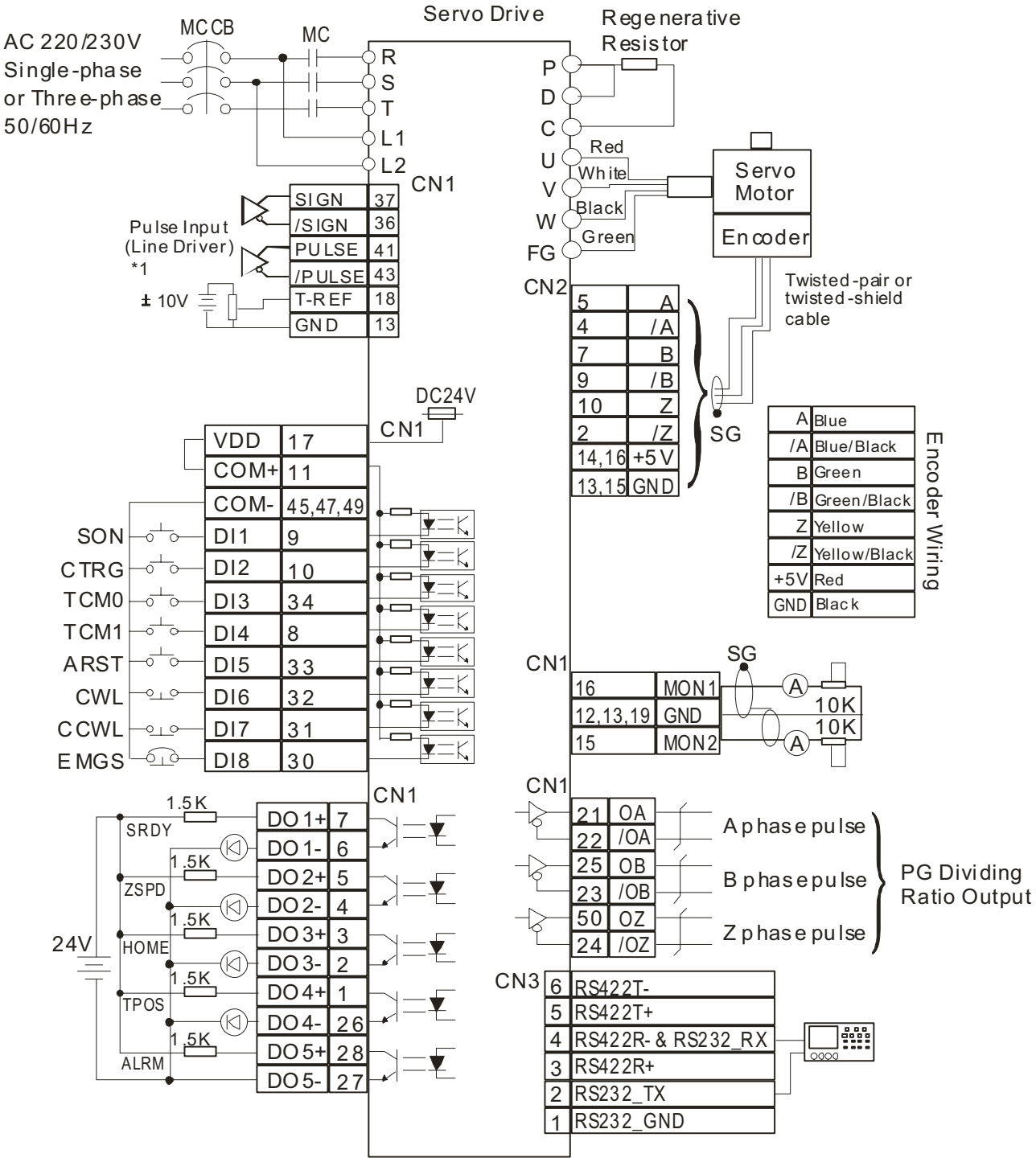
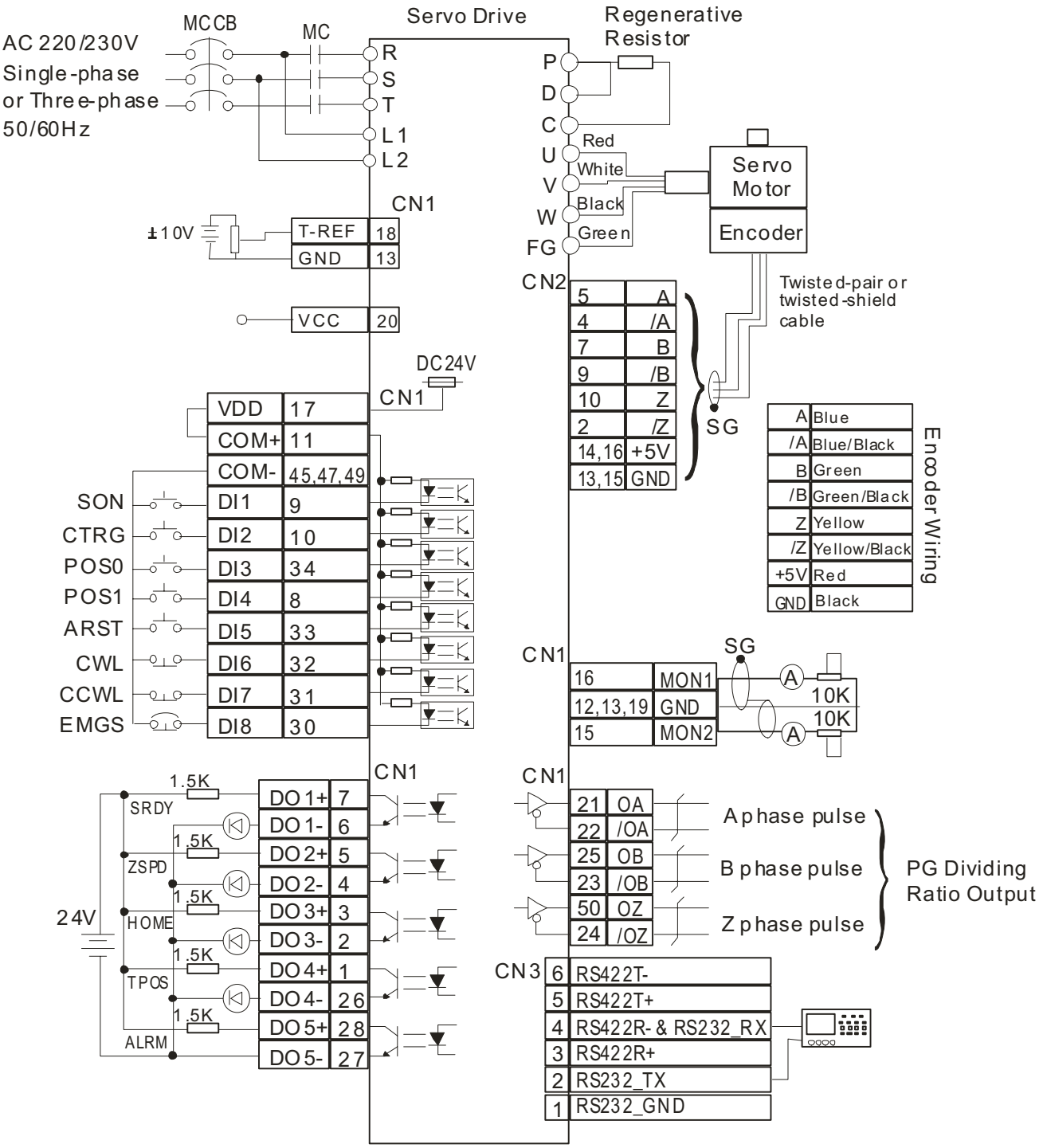
3-6 Standard Connection Example

3-6-1 Position (Pt) Control Mode



*1: Please refer to the C4 wiring diagram on page 3-25. If it is open-collector input, please refer to C3 wiring diagram.

3-6-2 Position (Pr) Control Mode



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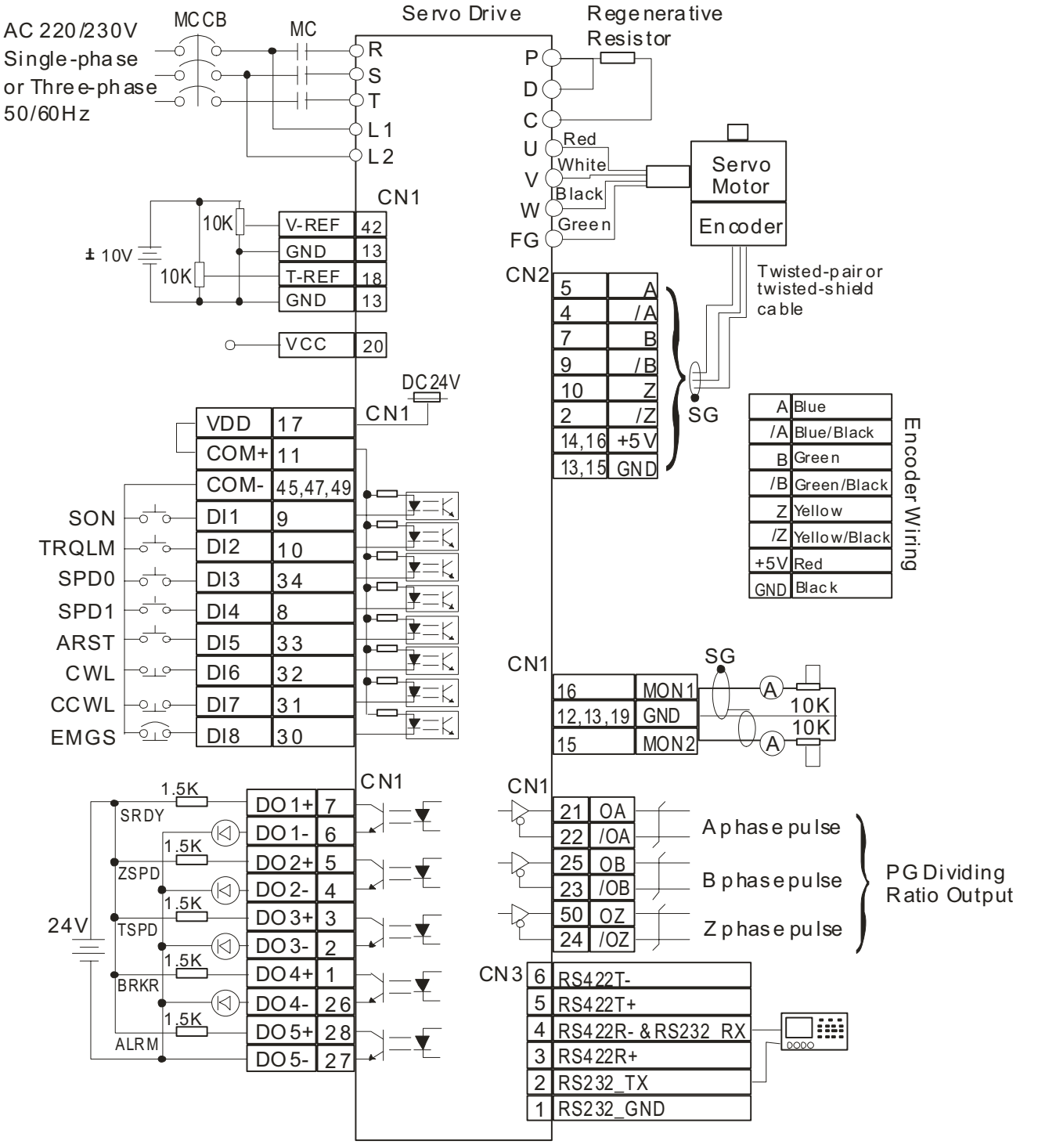
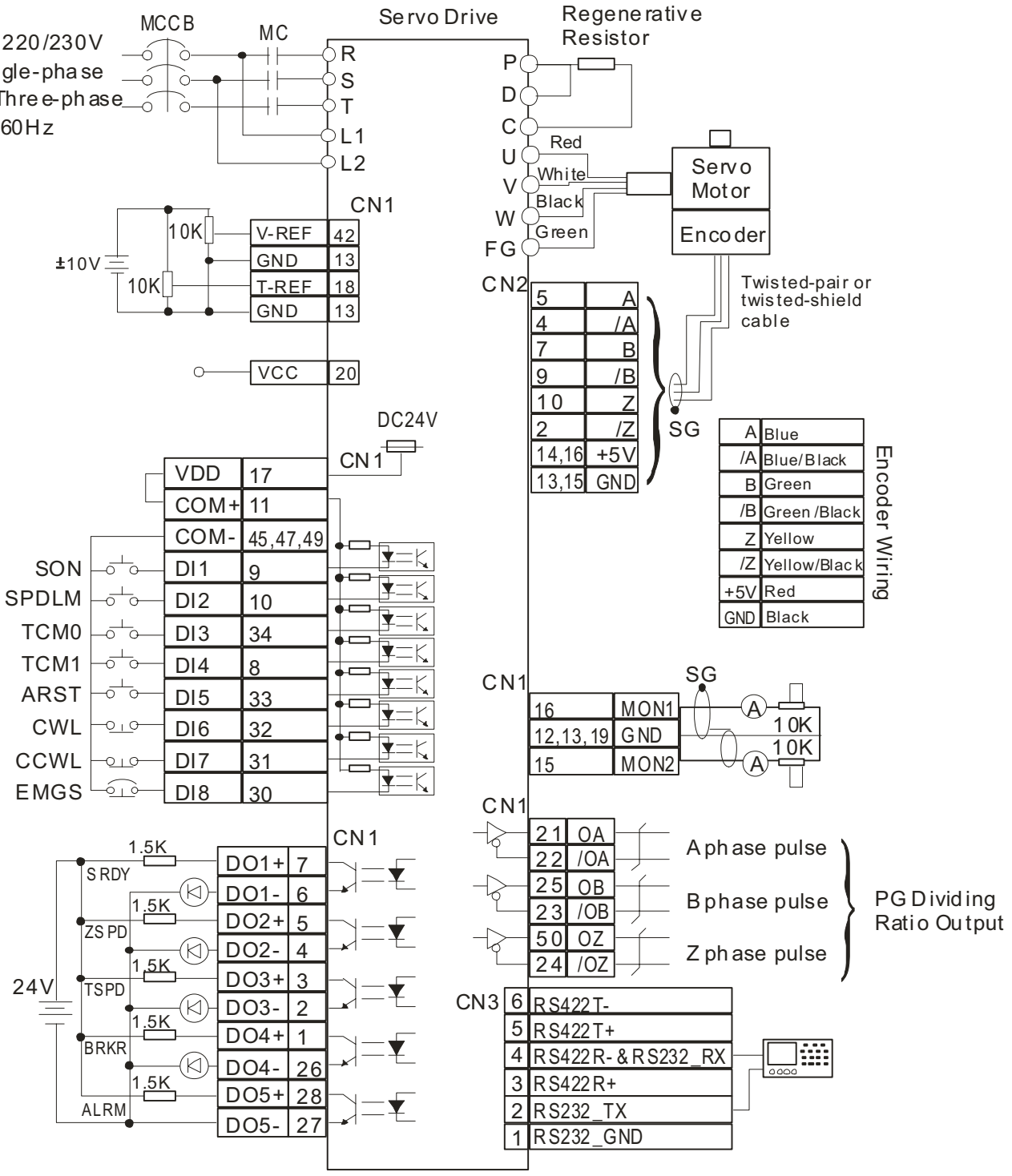
3-6-3 Speed Control Mode



3-6-4 Torque Control Mode



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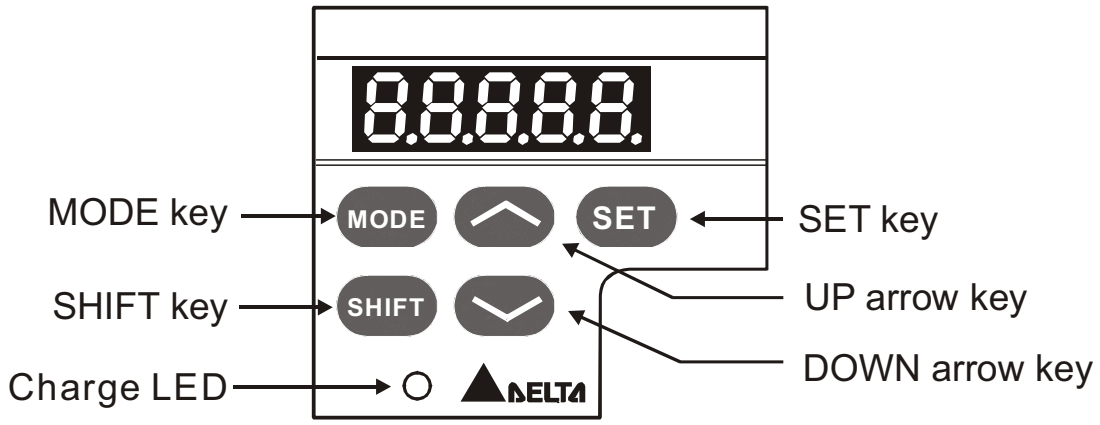
Chapter 4 Display and Operation

This chapter describes the basic operation of the digital keypad and the features it offers.

4-1 Digital Keypad

The digital keypad includes the display panel and function keys. The Figure 4.1 shows all of the features of the digital keypad and an overview of their functions.

Figure 4.1



Name	Function
LCD Display	The LCD Display (5-digit, 7-step display panel) shows the monitor codes, parameter settings and operation values of the AC servo drive.
Charge LED	The Charge LED lights to indicate the power is applied to the circuit.
MODE Key	Pressing the MODE key can enter or exit different parameter groups and setting mode.
SHIFT Key	Pressing the SHIFT key can change the parameter group code. After the parameter group code is set, users can move the cursor to left and change the parameter settings (blinking) by pressing the SHIFT key.
UP arrow Key	Pressing the UP arrow key can scroll through the parameter groups, the various parameter settings in each group and change parameter settings.
DOWN arrow Key	Pressing the DOWN arrow key can scroll through the parameter groups, the various parameter settings in each group and change parameter settings.
SET Key	Pressing the SET key can select, display and save the parameter groups, the various parameter settings.

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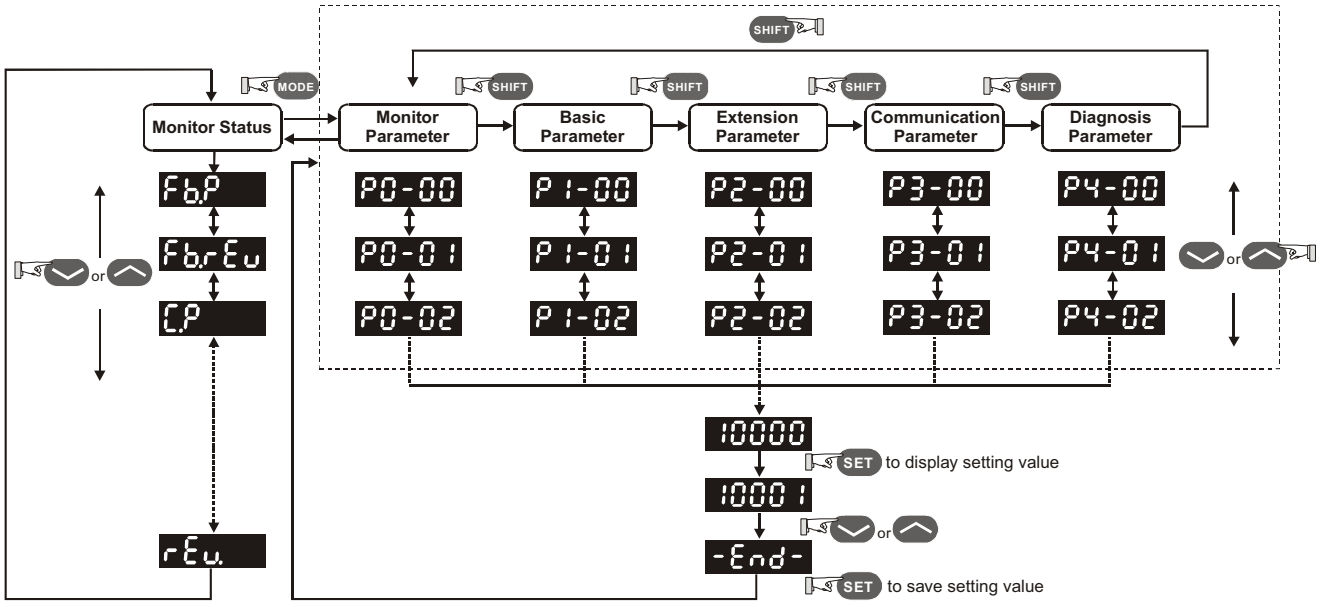
4-2 Display Flowchart

Figure 4.2 Keypad Operation



(1) When the power is applied to the AC servo drive, the LCD display will show the monitor display symbol for approximately one second, then enter into the monitor display mode.

(2) In monitor mode, pressing UP or DOWN arrow key can switch monitor parameter code. At this time, monitor display symbol will display for approximately one second.

(3) In monitor mode, pressing Mode key can enter into parameter mode, pressing the Shift key can switch parameter group and pressing UP or DOWN arrow key can change parameter group code.

(4) In parameter mode, system will enter into the setting mode immediately after the Set key is pressed. The LCD display will display the corresponding setting value of this parameter simultaneously. Then, users can use UP or DOWN arrow key to change parameter value or press Mode to exit and return back to the parameter mode.

(5) In setting mode, users can move the cursor to left by pressing the SHIFT key and change the parameter settings (blinking) by pressing the UP or DOWN arrow key.

(6) After the setting value change is completed, press Set key to save parameter setting or execute command.

(7) When the parameter setting is completed, LCD display will show the end code “-END-“ and automatically return back to monitor mode.

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4-3 Status Display

4-3-1 Save Setting Display

After the Set key is pressed, LCD display will show the following display messages for approx. one second according to different status.

Display Message	Description
	The setting value is saved correctly.
	Read only. Write-protected.
	Invalid password or no password input
	The setting value is error or input reserve setting value.
	Servo system is running and it is unable to input.
	This parameter will not be stored in EEPROM.
	This parameter is valid after restarting the drive.

4-3-2 Abort Setting Display

Display Message	Description
	In parameter mode, press Mode key to abort parameter setting. In setting mode, pressing Mode key can return back to parameter mode. After returning back to parameter mode, press Mode key again can abort parameter setting.

4-3-3 Fault Message Display

Display Message	Description
	When the AC servo drive has a fault, LCD display will display “ALEnn”. “ALE” indicates the alarm and “nn” indicates the alarm code. The display range of alarm code “nn” is 1 to 22. For the information of fault code, please refer to parameter P0-01.

4-3-4 Positive/Negative Symbol Setting Display

Display Message	Description
	When entering into setting mode, pressing UP or DOWN arrow key can increase/decrease the display value. SHIFT key is used to change the selected digit (The selected digit will blink).

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Display Message	Description
	When the parameter setting is greater than four digits, after the display value is set, continuously press SHIFT key for many times and then decimal points in the upper four digits will light. Negative value is indicated by the lit decimal points in the upper four digits.
	If the parameter value is less than five digits, the negative value is indicated by symbol "－". Reverse rotation is also indicates by symbol "－".

4-3-5 Monitor Setting Display

When the AC servo drive is applied to power, the LCD display will show the monitor display symbols for approximately one second and then enter into the monitor display mode. In monitor display mode, pressing UP or DOWN arrow key can change the monitor state or directly change parameter P0-02 to specify the monitor status. When the power is applied, the setting value of P0-02 is the default monitor code. For example, if the setting value of P0-02 is 2 when the power is applied, the C.P monitor symbol will first display and then the pulse command input pulse number will display after.

Settings of P0-02	Display Message	Description	Unit
0		Feedback pulse number of servo motor (Absolute value)	[pulse]
1		Feedback rotation number of servo motor (Absolute value)	[rev]
2		Input pulses of pulse command	[pulse]
3		Rotation number of pulse command	[rev]
4		Error pulse number of pulse command and feedback pulse	[pulse]
5		Input frequency of pulse command	[kHz]
6		Motor rotation speed	[rpm]
7		Speed input command 1	[V]
8		Speed input command 2	[rpm]
9		Torque input command 1	[V]
10		Torque input command 2	[%]

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Settings of P0-02	Display Message	Description	Unit
11		Average Torque	[%]
12		Peak Torque	[%]
13		Main circuit voltage	[V]
14		Ratio of Load/Motor inertia	[times]
15		Feedback pulse number of servo motor (Relative value)	[pulse]
16		Feedback rotation number of servo motor (Relative value)	[rev]

The following table lists the display examples of monitor value:

Display Message	Description
	Positive value display. Display value: +1234.
	Negative value display (The decimal place is lower than five) Display value: -1234.
	Negative value display (The decimal place is greater than four) Display value: -12345.
	Decimal point display Display value: 12.34.

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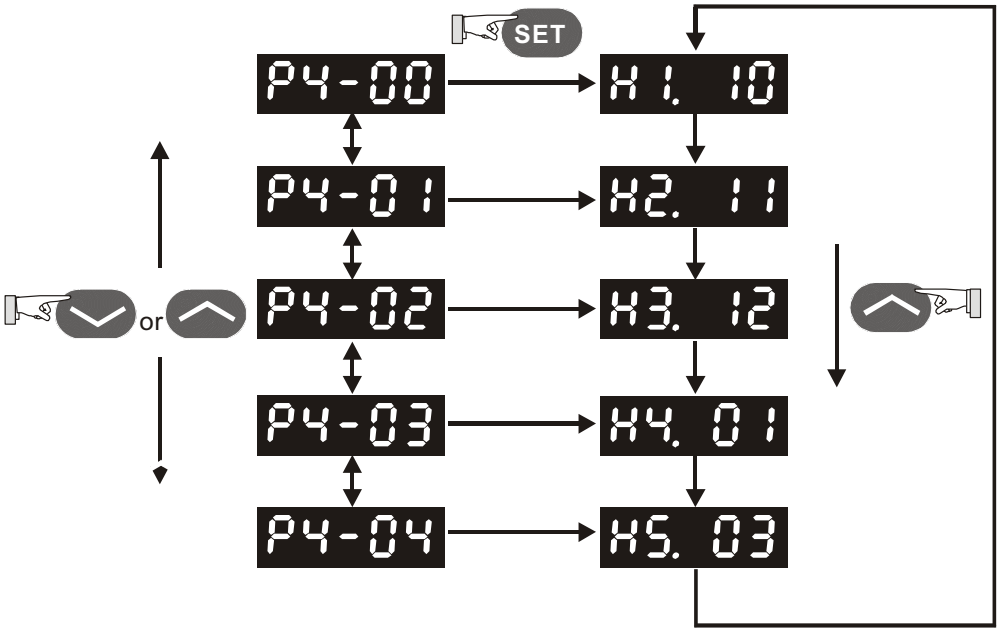
4-4 General Function Operation

4-4-1 Error Status Display Operation

After entering the parameter mode P4-00 to P4-04, press Set key to display the corresponding error code history or press UP arrow key to display the error code of H1 to H5 in order. H1 indicates the most recently occurred error code, H2 is the previous occurred error code before H1 and so forth. Please refer to the Figure 4.3. The recently occurred error code is 10.

Figure 4.3



4-4-2 JOG Operation

After entering parameter mode P4-05, users can follow the following steps to perform JOG operation (Please also refer to Figure 4.4).

(1) Press the SET key to display the JOG rpm speed. (The default value is 20 rpm).

(2) Press the UP or DOWN arrow keys to increase or decrease the desired JOG speed. (This also can be undertaken by using the SHIFT key to move the cursor to the desired unit column (the effected number will flash) then changed using the UP and DOWN arrow keys).

(3) Press the SET when the desired JOG speed is displayed. The Servo Drive will display "JOG"

(4) Press the UP or DOWN arrow keys to jog the motor either CCW or CW. The motor will only rotation while the arrow key is activated.

(5) To change JOG speed again, press the MODE key. The servo Drive will display "P4 - 05". Press the SET key and the JOG rpm speed will displayed again. Refer back to #2 and #3 to change speed.

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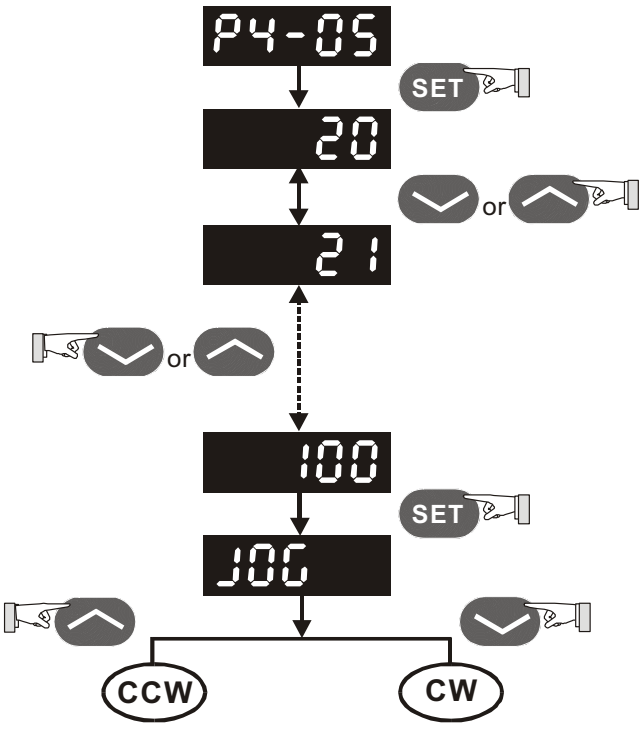
Figure 4.4



4-4-3 Position Learning Operation

Follow the following steps to perform position learning operation (Please also refer to Figure 4.5).

(1) Activate the internal position learning function (Set P2-30=4).

(2) After enter into parameter mode P4-05, press Set key and the LED display will show learning moving speed value. The default setting is 20 rpm.

(3) Press UP or DOWN arrow key to set the desired moving speed value. In the example shown below, the value is adjusted to 100rpm.

(4) Press Set key then JOG o1 will display and enter position learning mode.

(5) In the position learning mode (display JOGox), pressing UP or DOWN arrow key at any time can rotate Servo motor in forward or reverse rotation. Servo motor will immediately stop running if releasing the UP or DOWN arrow key. This operation is only available during Servo system is On (Servo On).

(6) After position is selected, press Set key then the display JOGo1 will change to JOGo2. At the same time, the absolute position of servo motor will be memorized inside of the memory. (P1-17 : rotation numbers, P1-18 : corresponding remaining pulses)

(7) In the position learning mode (display JOGox), pressing Shift key can directly change the “x” value of the display “JOGox” so as to jump rapidly to the particular learning position where should be modified. There is no position memorized at this time.

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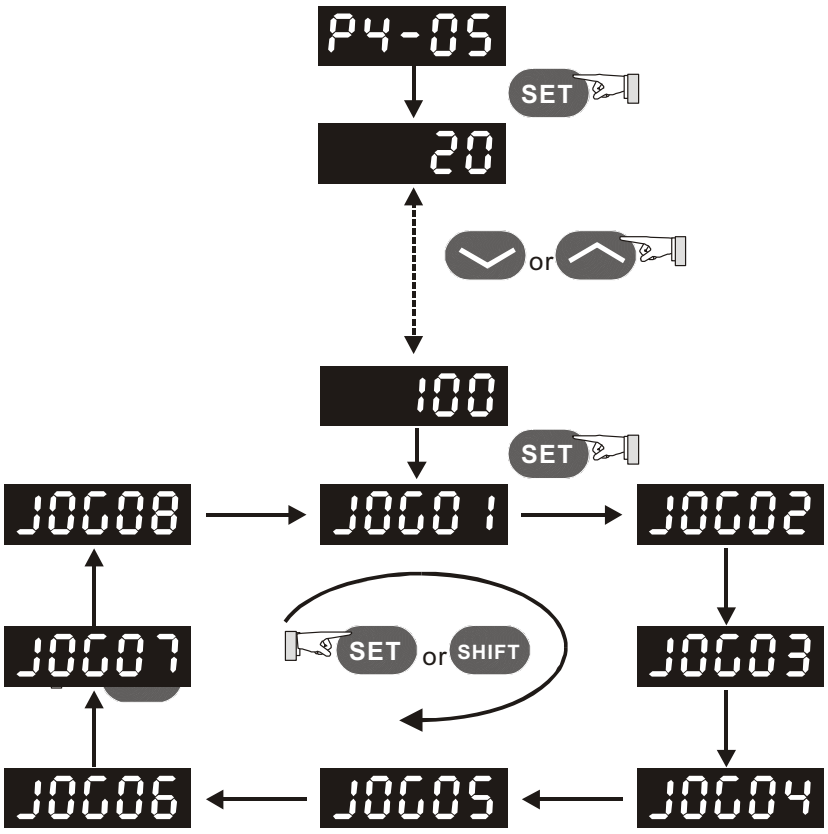
Figure 4.5



The learning position and Internal memorized position are listed as below:

Learning Position	Internal Memorized Position
JOGo1	P1-15(Position rotation number), P1-16(Position pulse number)
JOGo2	P1-17(Position rotation number), P1-18(Position pulse number)
JOGo3	P1-19(Position rotation number), P1-20(Position pulse number)
JOGo4	P1-21(Position rotation number), P1-22(Position pulse number)
JOGo5	P1-23(Position rotation number), P1-24(Position pulse number)
JOGo6	P1-25(Position rotation number), P1-26(Position pulse number)
JOGo7	P1-27(Position rotation number), P1-28(Position pulse number)
JOGo8	P1-29(Position rotation number), P1-30(Position pulse number)

4-4-4 DO signal Force Output Diagnosis Operation

The digital output signal can be forced to be ON or OFF. Follow the setting method in Figure 4.6 to enter into DO signal force output diagnosis operation (OP x) mode. Pressing UP or DOWN arrow key can change “x” value from 1 to 5 and force digital output signals DO1 to DO5 to be ON or OFF. (Please also refer to Figure 4.6).

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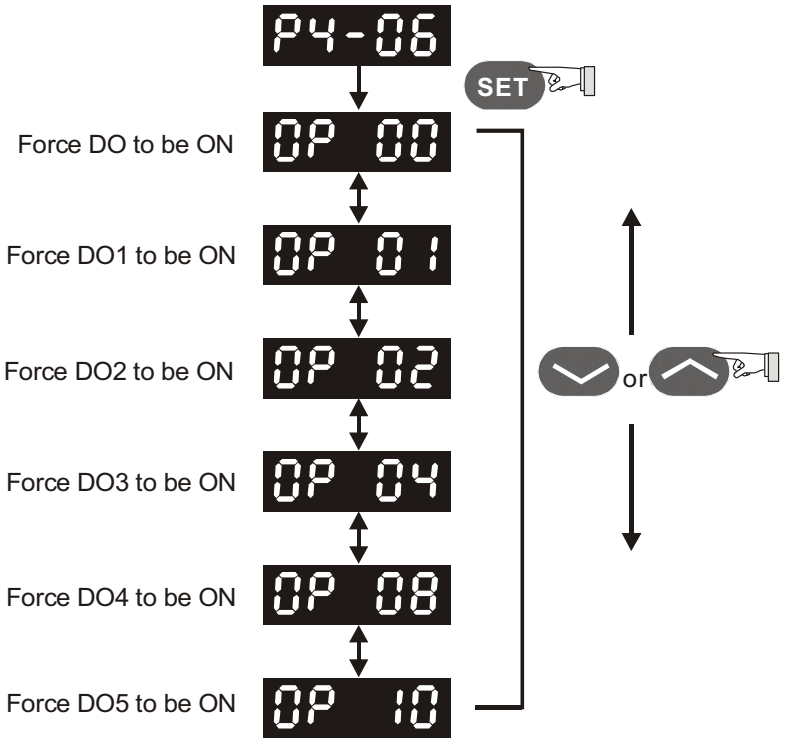
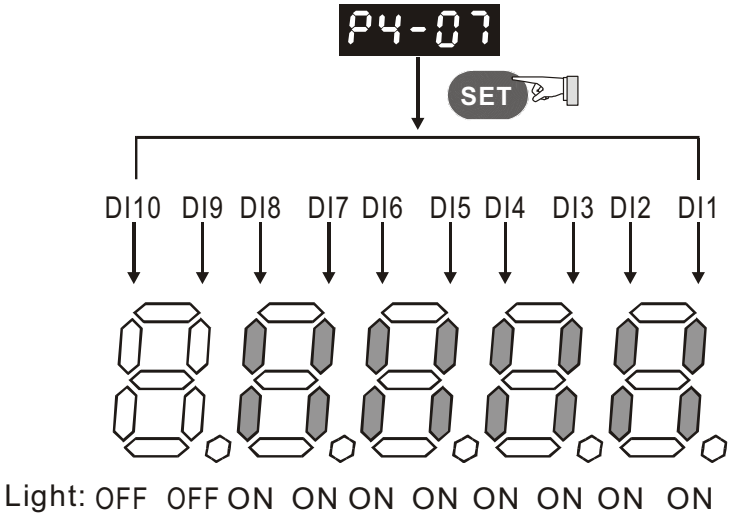
Figure 4.6



4-4-5 DI signal Display Diagnosis Operation

Follow the setting method in Figure 4.7 to enter into DI signal display diagnosis operation mode. According to the ON and OFF status of external input signal DI1 to DI8, the corresponding signal status will display on the LED display. When the segment lit and display on the screen, it means that the digital input signal is ON. (Please also refer to Figure 4.7).

Figure 4.7



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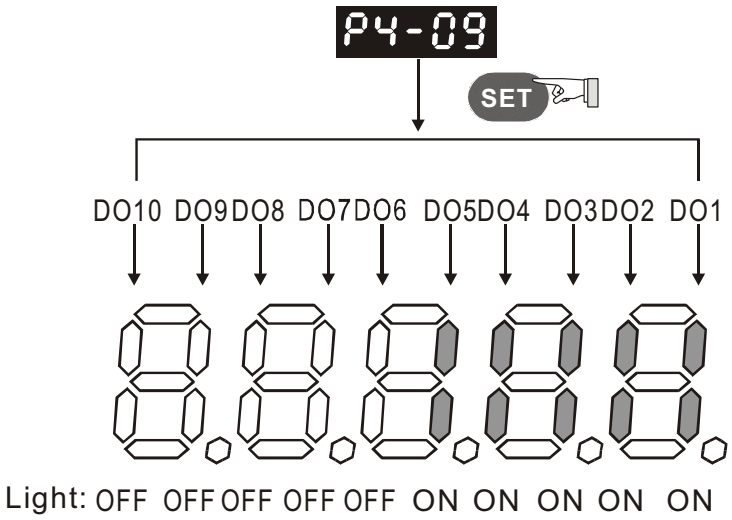
4-4-6 DO signal Display Diagnosis Operation

Follow the setting method in Figure 4.8 to enter into DO signal display diagnosis operation mode. According to the ON and OFF status of digital output signals DO1 to DO5, the corresponding signal status will display on the LED display. When the segment lit and display on the screen, it means that the digital input signal is ON. (Please also refer to Figure 4.8)

Figure 4.8



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Chapter 5 Trial Run and Tuning Procedure

This chapter, which is divided into two parts, describes trial run for servo drive and motor. One part is to introduce the trial run without load, and the other part is to introduce trial run with load. Ensure to complete the trial run without load first before performing the trial run with load.

5-1 Inspection without Load

In order to prevent accidents and avoid damaging the servo drive and mechanical system, the trial run should be performed under no load condition (no load connected, including disconnecting all couplings and belts). Do not run servo motor while it is connected to load or mechanical system because the unassembled parts on motor shaft may easily disassemble during running and it may damage mechanical system or even result in personnel injury. After removing the load or mechanical system from the servo motor, if the servo motor can runs normally following up the normal operation procedure (when trial run without load is completed), then user can connect to the load and mechanical system to run the servo motor.

⚠ CAUTION	• Please perform trial run without load first and then perform trial run with load connected. After the servo motor is running normally and regularly without load, then run servo motor with load connected. Ensure to perform trial run in this order to prevent unnecessary danger.

After power in connected to AC servo drive, the charge LED will light and it indicates that AC servo drive is ready. Please check the followings before trial run:

Inspection before operation (Control power is not applied)	1. Ensure that all wiring terminals are correctly insulated. 2. Ensure that all wiring is correct or damage and or malfunction may result. 3. Visually check to ensure that there are not any unused screws, metal strips, or any conductive or inflammable materials inside the drive. 4. To avoid an electric shock, be sure to connect the ground terminal of servo drive to the ground terminal of control panel. Before making any connection, wait 10 minutes for capacitors to discharge after the power is disconnected, alternatively, use an appropriate discharge device to discharge. 5. Make sure control switch is OFF. 6. Never put inflammable objects on servo drive or close to the external regenerative resistor. 7. If the electromagnetic brake is being used, ensure that it is correctly wired. 8. If required, use an appropriate electrical filter to eliminate noise to the servo drive. 9. Ensure that the external applied voltage to the drive is correct and matched to the controller.
Inspection during operation (Control power is applied)	1. Ensure that the cables are not damaged, stressed excessively or loaded heavily. When the motor is running, pay close attention on the connection of the cables and notice that if they are damaged, frayed or over extended. 2. Check for abnormal vibrations and sounds during operation. If the servo motor is vibrating or there are unusual noises while the motor is running, please contact the distributor or manufacturer for assistance. 3. Ensure that all user defined parameters are set correctly.

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Inspection during operation (Control power is applied)	4. Reset parameters when the servo drive is off. Otherwise, it may result in malfunction. 5. Ensure correct operation when using a relay and request assistance should there be any unusual noises. 6. Check for abnormal conditions of the power indicators and LED display.

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5-2 Applying Power to the Drive

Users please observe the following steps when applying power supply to the servo drive.

1. Please check and confirm the wiring connection between the drive and motor is correct.

   1) Terminal U, V, W and FG (frame ground) must connect to Red, White, Black and Green cables separately (U: Red, V: White, W: Black, FG: Green). If not connect to the specified cable and terminal, then the drive cannot control motor. The motor grounding lead, FG must connect to grounding terminal. For more information of cables, please refer to section 3-1.

   2) Ensure to connect encoder cable to CN2 connector correctly. If users only desire to execute JOG operation, it is not necessary to make any connection to CN1 and CN3 connector. For more information of the connection of CN2 connector, please refer to Section 3-1 and 3-4.

⚠ CAUTION	● Do not connect the AC input power (R, S, T) to the U, V, W output terminals. This will damage the AC servo drive.

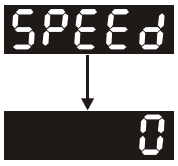
2. Main circuit wiring

   Connect power to the AC servo. For three-phase input power connection and single-phase input power connection, please refer to Section 3-1-3.

3. Turn the Power On

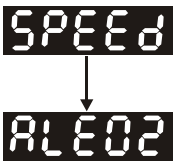
   The Power includes control circuit power (L1, L2) and main circuit power (R, S, T). When the power is on, the normal display should be shown as the following figure:

   As the default settings of digital input signal, DI6, DI7 and DI8 are Reverse Inhibit Limit (CWL), Forward Inhibit Limit (CCWL) and Emergency Stop (EMGS) respectively, if need be, the user can change the settings by using parameters P2-15 to P2-17 freely. When the setting value of parameters P2-15 to P2-17 is 0, it indicates the function of this DI signal is disabled. For more information of parameters P2-15 to P2-17, please refer to Chapter 7 “Parameters”.
   If the parameter P0-02 is set as motor speed (06), the normal display should be shown as the following figure:



   If there is no text or character displayed on the LED display, please check if the voltage of the control circuit terminal (L1and L2) is over low.

   1) When display shows:



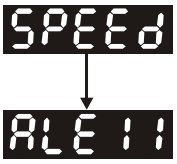
Over voltage:

The main circuit voltage has exceeded its maximum allowable value or input power is error (Incorrect power input).

Corrective Actions:

- Use voltmeter to check whether the input voltage falls within the rated input voltage.
- Use voltmeter to check whether the input voltage is within the specified limit.

2) When display shows:



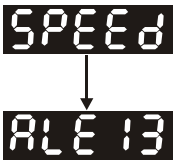
Encoder error:

Check if the wiring is correct. Check if the encoder wiring of servo motor is loose or not.

Corrective Actions:

- Check if the user performs wiring recommended in the user manual.
- Examine the encoder connector
- Inspect whether wire is loose or not.
- Check if the encoder is damaged.

3) When display shows:



Emergency stop activated:

Please check if any of digital inputs DI1~DI8 signal is set to “Emergency Stop” (EMGS).

Corrective Actions:

- If it is no need to use “Emergency Stop (EMGS)” as input signal, it only needs to confirm that if all of the digital inputs DI1~DI8 are not set to “Emergency Stop (EMGS)”. (The setting value of parameter P2-10 to P2-17 is not set to 21.)
- If it is necessary to use “Emergency Stop (EMGS)” as input signal, it only needs to confirm that which of digital inputs DI1~DI8 is set to “Emergency Stop (EMGS)” and check if the digital input signal is ON (It should be ON).

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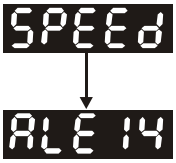
4) When display shows:



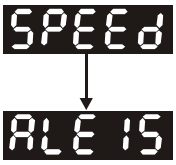
Reverse limit switch error:

Please check if any of digital inputs DI1~DI8 signal is set to “Reverse inhibit limit (CWL)” and check if the signal is ON or not.

Corrective Actions:

- If it is no need to use “Reverse inhibit limit (CWL)” as input signal, it only needs to confirm that if all of the digital inputs DI1~DI8 are not set to “Reverse inhibit limit (CWL)”. (The setting value of parameter P2-10 to P2-17 is not set to 22.)
- If it is necessary to use “Reverse inhibit limit (CWL)” as input signal, it only needs to confirm that which of digital inputs DI1~DI8 is set to “Reverse inhibit limit (CWL)” and check if the digital input signal is ON (It should be ON).

5) When display shows:



Forward limit switch error:

Please check if any of digital inputs DI1~DI8 signal is set to “Forward inhibit limit (CCWL)” and check if the signal is ON or not.

Corrective Actions:

- If it is no need to use “Forward inhibit limit (CCWL)” as input signal, it only needs to confirm that if all of the digital inputs DI1~DI8 are not set to “Forward inhibit limit (CCWL)”. (The setting value of parameter P2-10 to P2-17 is not set to 23.)
- If it is necessary to use “Forward inhibit limit (CCWL)” as input signal, it only needs to confirm that which of digital inputs DI1~DI8 is set to “Forward inhibit limit (CCWL)” and check if the digital input signal is ON (It should be ON).

If the “

” show on the display and “digital input 1” is set to Servo On (SON), it indicates that Servo on (SON) function is enabled.

6) When display shows:

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Overcurrent:

Corrective Actions:

- Check the wiring connections between drive and motor.
- Check if the circuit of wire is closed.
- Repair the short-circuited and avoid metal conductor being exposed.

7) When display shows:

Undervoltage:

Corrective Actions:

- Check whether the wiring of main circuit input voltage is normal.
- Use voltmeter to check whether input voltage of main circuit is normal.
- Use voltmeter to check whether the input voltage is within the specified specification.

🕮 **Note:** If there are any unknown fault codes and abnormal display when applying power to the drive or servo on is activated (without giving any command), please inform the distributor for assistance.

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5-3 JOG Trial Run without Load

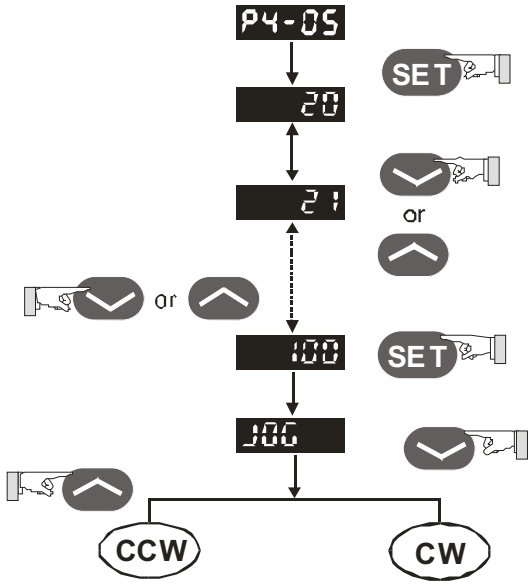
It is very convenient to use JOG trial run without load because it can save the wiring. For safety, it is recommended to set JOG speed at low speed. Please refer to the following steps to perform JOG trial run without load.

STEP 1: Turn the drive ON through software. The setting value of parameter P2-30 should be set to 1 (servo on).

STEP 2: Set parameter P4-05 as JOG speed (unit: rpm). After the desired JOG speed is set, and then press SET key, the drive will enter into JOG operation mode automatically.

STEP 3: When pressing MODE key, it can exit JOG operation mode.

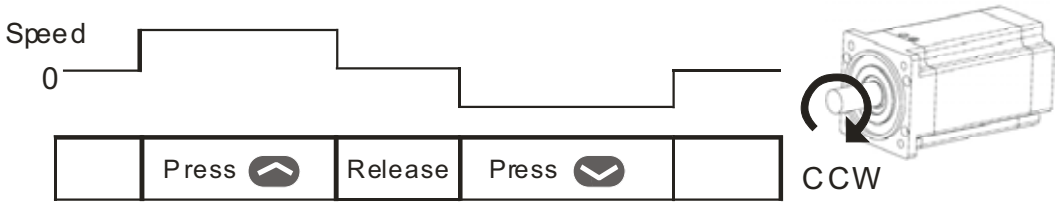
In the example below, the JOG speed is adjusted from 20rpm (Default setting) to 100rpm.



Press key : Servo motor will run in CCW direction.
After releasing the Up key, the motor will stop running.

Press key : Servo motor will run in CW direction.

Face the servo motor shaft
CCW (Counterclockwise): Reverse running
CW (Clockwise): Forward running



If the servo motor does not rotate, please check if the wiring of U, V, W terminals and encoder is correct or not.

If the servo motor does not rotate properly, please check if the phase of U, V, W cables is connected correctly.

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5-4 Speed Trial Run without Load

Before speed trial run, fix and secure the motor as possible to avoid the danger from the reacting force when motor speed changes.

STEP 1：

Set the value of parameter P1-01 to 02 and it is speed (S) control mode. After selecting the operation mode as speed (S) control mode, please restart the drive and the setting would be valid.

STEP 2：

In speed control mode, the necessary DI setting is listed as follows:

Digital Input	Parameter Setting Value	Sign	Function Description	CN1 PIN No.
DI1	P2-10=101	SON	Servo On	DI1-=9
DI2	P2-11=109	TRQLM	Torque limit enabled	DI2-=10
DI3	P2-12=114	SPD0	Speed command selection	DI3-=34
DI4	P2-13=115	SPD1	Speed command selection	DI4-=8
DI5	P2-14=102	ARST	Reset	DI5-=33
DI6	P2-15=0	Disabled	This DI function is disabled	-
DI7	P2-16=0	Disabled	This DI function is disabled	-
DI8	P2-17=0	Disabled	This DI function is disabled	-

In the above table, the functions of reverse inhibit limit (DI6), forward inhibit limit (DI7) and emergency stop (DI8) are disabled, i.e. the setting value of parameters P2-15 to P2-17 is set to 0 (Disabled). All the digital inputs of Delta ASDA-A series are user-defined, and the user can set the DI signals freely. Ensure to refer to the definitions of DI signals before defining them.

If alarm code display, the user can restart the drive or set DI5 to be ON to clear the fault. Please refer to section 5-2.

The speed command is selected by SPD0, SPD1. Please refer to the following table:

Speed Command No.	DI signal of CN1		Command Source	Content	Range
	SPD1	SPD0			
S1	0	0	External analog command	Voltage between V-REF and GND	+/-10V
S2	0	1	Internal parameter	P1-09	0~5000rpm
S3	1	0		P1-10	0~5000rpm
S4	1	1		P1-11	0~5000rpm

0: indicates OFF (Normally Open)

1: indicates ON (Normally Closed)

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The settings of speed command:

P1-09 is set to 3000
P1-10 is set to 100
P1-11 is set to -3000

Input value command	Rotation direction
+	CW
-	CCW

STEP 3：

(1) The user can use DI1 to activate the servo drive (Servo ON).

(2) If DI3 (SPD0) and DI4 (SPD1) are OFF both, it is S1 command. At this time, the motor is operating according to external analog command.

(3) If only DI3 is ON (SPD0), it indicates S2 command (P1-09 is set to 3000) is selected, and the motor speed is 3000rpm at this time.

(4) If only DI4 is ON (SPD1), it indicates S3 command (P1-10 is set to 100) is selected, and the motor speed is 100rpm at this time.

(5) If DI3 (SPD0) and DI4 (SPD1) are ON both, it indicates S4 command (P1-11 is set to -3000) is selected, and the motor speed is -3000rpm at this time.

(6) Repeat the action of (3), (4), (5).

(7) When the motor is stopping, set DI to be OFF (Servo OFF).

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5-5 Position Trial Run without Load

Before position trial run, fix and secure the motor as possible to avoid the danger from the reacting force when the motor speed changes.

STEP 1：

Set the value of parameter P1-01 to 01 and it is position (Pr) control mode. After selecting the operation mode as position (Pr) control mode, please restart the drive and the setting would be valid.

STEP 2：

In position control mode, the necessary DI setting is listed as follows:

Digital Input	Parameter Setting Value	Sign	Function Description	CN1 PIN No.
DI1	P2-10=101	SON	Servo On	DI1-=9
DI2	P2-11=108	CTRG	Command trigged	DI2-=10
DI3	P2-12=111	POS0	Position command selection	DI3-=34
DI4	P2-13=112	POS1	Position command selection	DI4-=8
DI5	P2-14=102	ARST	Reset	DI5-=33
DI6	P2-15=0	Disabled	This DI function is disabled	-
DI7	P2-16=0	Disabled	This DI function is disabled	-
DI8	P2-17=0	Disabled	This DI function is disabled	-

In the above table, the functions of reverse inhibit limit (DI6), forward inhibit limit (DI7) and emergency stop (DI8) are disabled, i.e. the setting value of parameters P2-15 to P2-17 is set to 0 (Disabled). All the digital inputs of Delta ASDA-A series are user-defined, and the user can set the DI signals freely. Ensure to refer to the definitions of DI signals before defining them.

If alarm code display, the user can restart the drive or set DI5 to be ON to clear the fault. Please refer to section 5-2.

For the information of wiring diagram, please refer to Section 3-6-2 (Wiring of position (Pr) control mode). Because POS2 is not the default DI, therefore, the user needs to change the value of parameter P2-14 to 113.

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The relationship of position command (1~8) and POS0 ~ POS2 is listed as the table below:

Position Command	POS2	POS1	POS0	CTRG	Parameters	Moving Speed Register	Description
Internal Position 1	0	0	0	↑	P1-15	P2-36 (V1)	Rotation No. (+/- 30000)
					P1-16		Pulse No. (+/- max cnt)
Internal Position 2	0	0	1	↑	P1-17	P2-37 (V2)	Rotation No. (+/- 30000)
					P1-18		Pulse No. (+/- max cnt)
Internal Position 3	0	1	0	↑	P1-19	P2-38 (V3)	Rotation No. (+/- 30000)
					P1-20		Pulse No. (+/- max cnt)
Internal Position 4	0	1	1	↑	P1-21	P2-39 (V4)	Rotation No. (+/- 30000)
					P1-22		Pulse No. (+/- max cnt)
Internal Position 5	1	0	0	↑	P1-23	P2-40 (V5)	Rotation No. (+/- 30000)
					P1-24		Pulse No. (+/- max cnt)
Internal Position 6	1	0	1	↑	P1-25	P2-41 (V6)	Rotation No. (+/- 30000)
					P1-26		Pulse No. (+/- max cnt)
Internal Position 7	1	1	0	↑	P1-27	P2-42 (V7)	Rotation No. (+/- 30000)
					P1-28		Pulse No. (+/- max cnt)
Internal Position 8	1	1	1	↑	P1-29	P2-43 (V8)	Rotation No. (+/- 30000)
					P1-30		Pulse No. (+/- max cnt)

0: indicates OFF (Normally Open)

1: indicates ON (Normally Closed)

The user can set the value of these 8 groups of commands (P1-15 ~ P1-30) freely. The command can be absolute position command (P1-34 =0) or relative position command (P1-34 =1).

For example:

Set P1-33 to 1 (Absolute position command)

(The new setting will be valid after the drive is restarted)

Set P1-15 to 1 (rotation number)

Set P1-16 to 0 (pulse number)

The command of internal position 1: P1-15 Rotation No. + P1-16 Pulse No.

Set P1-17 to 10 (rotation number)

Set P1-18 to 0 (pulse number)

The command of internal position 2: P1-17 Rotation No. + P1-18 Pulse No.

Set P1-19 to -10 (rotation number)

Set P1-20 to 0 (pulse number)

The command of internal position 3: P1-19 Rotation No. + P1-20 Pulse No.

Set P1-21 to 100 (rotation number)

Set P1-22 to 0 (pulse number)

The command of internal position 4: P1-21 Rotation No. + P1-22 Pulse No.

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Set P1-23 to -1000 (rotation number)
Set P1-24 to 0 (pulse number)
The command of internal position 5: P1-23 Rotation No. + P1-24 Pulse No.
Set P1-25 to 0 (rotation number)
Set P1-26 to 100 (pulse number)
The command of internal position 6: P1-25 Rotation No. + P1-26 Pulse No.
Set P1-27 to 0 (rotation number)
Set P1-28 to 1000 (pulse number)
The command of internal position 7: P1-27 Rotation No. + P1-28 Pulse No.
Set P1-29 to -10 (rotation number)
Set P1-30 to 2500 (pulse number)
The command of internal position 8: P1-29 Rotation No. + P1-30 Pulse No.

Input command	Rotation direction
+	CW
-	CCW

STEP 3：

(1) The user can use DI1 to activate the servo drive (Servo ON).

(2) Set DI2 (CTRG) to be ON, it indicates the command of internal position 1 (P1-15 Rotation No. + P1-16 Pulse No.) 1 turn is selected, and the motor has rotated one turn at this time.

(3) Set DI3 (POS0) to be ON first and then activate DI2 (CTRG) to be ON, it indicates the command of internal position 2 (P1-17 Rotation No. + P1-18 Pulse No.)10 turn is selected, and the motor has rotated ten turns.

(4) Set DI3 (POS0), DI4 (POS1) and DI5 (POS2) to be ON first and then activate DI2 (CTRG) to be ON, it indicates the command of internal position 8 (P1-29 Rotation No. + P1-30 Pulse No.)10.25turn is selected, and the motor has rotated 10.25 turns.

(5) If DI3 (SPD0) and DI4 (SPD1) are ON both, it indicates S4 command (P1-11 is set to -3000) is selected, and the motor speed is -3000rpm at this time.

(6) Repeat the action of (3), (4), (5).

(7) When the motor is stopping, set DI to be OFF (Servo OFF).

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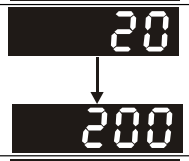
5-6 Tuning Procedure

Estimate the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor): JOG Mode

1.	After wiring is completed, when power in connected to the AC servo drive, the right side display will show on the LCD display.	
2.	Press MODE key to enter into parameter mode.	
3.	Press SHIFT key twice to select parameter group.	
4.	Press UP key to view each parameter and select parameter P2-30.	
5.	Press SET key to display the parameter value as shown on the right side.	
6.	Select parameter value 1. Use UP key to cycle through the available settings.	
7.	Press SET key to write parameter value to the drive, and the right side display will show on the LCD display.	
8.	At this time, the servo drive is ON and the right side display will appear next.	
9.	Press DOWN key three times to select the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor).	
10.	Display the current ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor). (5.0 is default setting.)	
11.	Press MODE key to select parameter mode.	
12.	Press SHIFT key twice to select parameter group.	
13.	Press UP key to select user parameter P4-05.	
14.	Press SET key and JOG speed 20rpm will be displayed. Press UP and DOWN key to increase and decrease JOG speed. To press SHIFT key one time can add one digit number.	
15.	Select desired JOG speed, press SET key and it will show the right side display.	
16.	Pressing UP key is forward rotation and pressing DOWN key is reverse rotation.	
17.	Execute JOG operation in low speed first. After the machine is running smoothly, then execute JOG operation in high speed.	
18.	The ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor) cannot be shown in the display of JOG parameter P4-05 operation. Please press MODE key twice continuously, and the user can see the ratio of Load Inertia to Servo Motor Inertia (J_load /J_motor). Then, execute JOG operation again, press MODE key once and press SET key twice to view the display on the keypad. Check if the value of J_load /J_motor is adjusted to a fixed value and displayed on the keypad after acceleration and deceleration repeatedly.	

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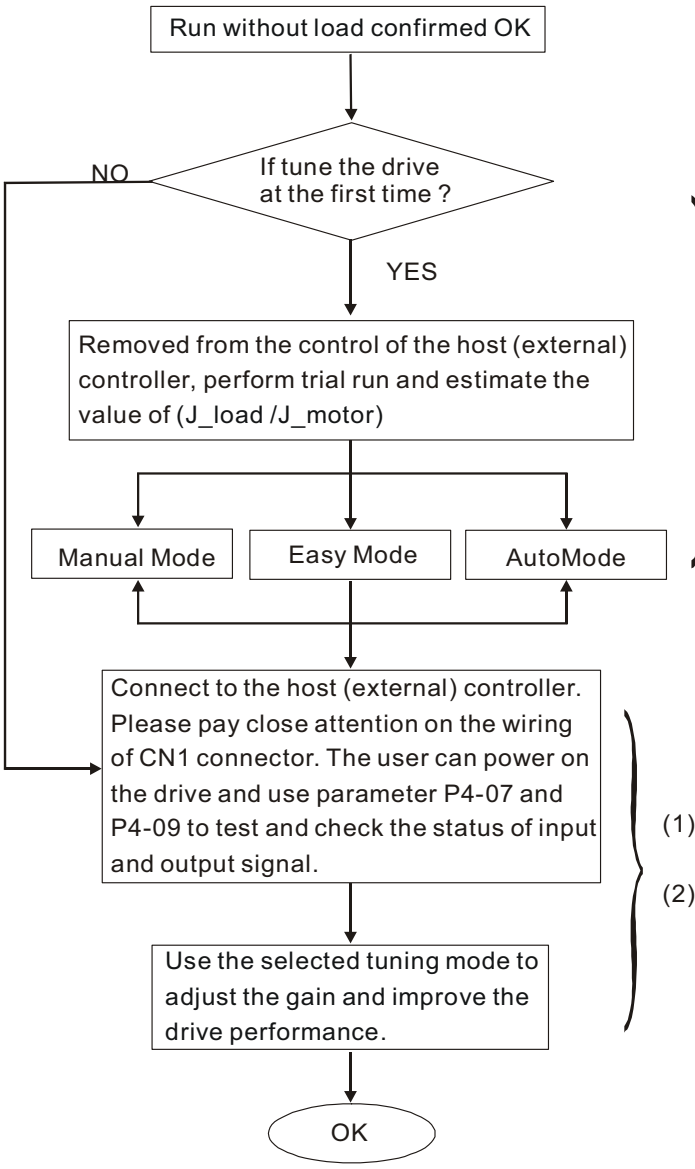
5-6-1 Tuning Flowchart


Run without load confirmed OK
If tune the drive at the first time ?
NO
YES
Removed from the control of the host (external) controller, perform trial run and estimate the value of (J_load /J_motor)
Manual Mode
Easy Mode
AutoMode
Connect to the host (external) controller. Please pay close attention on the wiring of CN1 connector. The user can power on the drive and use parameter P4-07 and P4-09 to test and check the status of input and output signal.
Use the selected tuning mode to adjust the gain and improve the drive performance.
OK

If the value of (J_load / J_motor) is estimated incorrectly, the optimum gain can not be adjusted.

(1) Must understand the customer specifications and what the customer really needs.
(2) Can use P2-23 and P2-24 to suppress the resonance of mechanical system.

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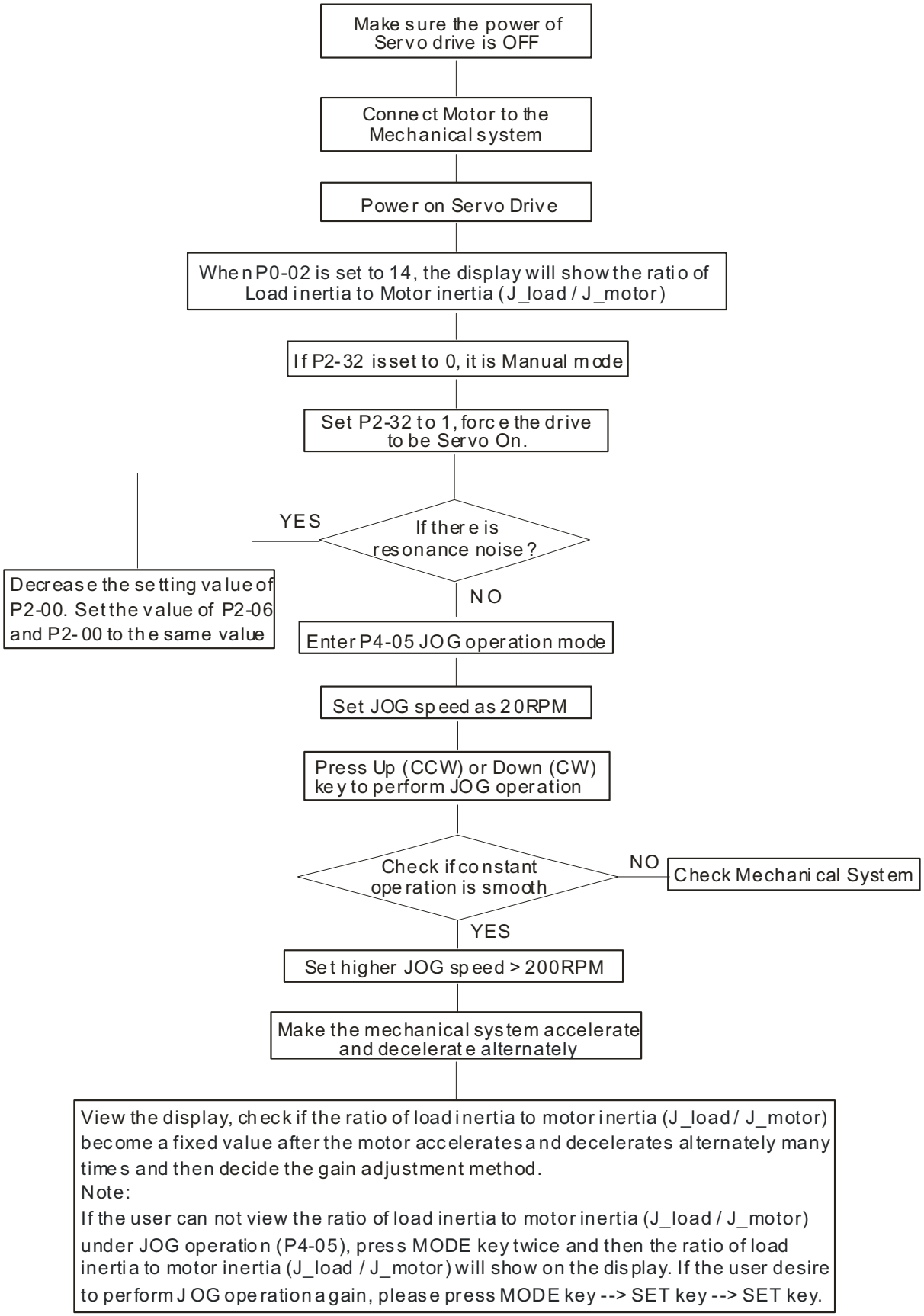
5-6-2 Load Inertia Estimation Flowchart


Make sure the power of Servo drive is OFF
Connect Motor to the Mechanical system
Power on Servo Drive
When P0-02 is set to 14, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
If P2-32 is set to 0, it is Manual mode
Set P2-32 to 1, force the drive to be Servo On.
If there is resonance noise?
YES
Decrease the setting value of P2-00. Set the value of P2-06 and P2-00 to the same value
NO
Enter P4-05 JOG operation mode
Set JOG speed as 20RPM
Press Up (CCW) or Down (CW) key to perform JOG operation
Check if constant operation is smooth
NO
Check Mechanical System
YES
Set higher JOG speed > 200RPM
Make the mechanical system accelerate and decelerate alternately
View the display, check if the ratio of load inertia to motor inertia (J_load / J_motor) become a fixed value after the motor accelerates and decelerates alternately many times and then decide the gain adjustment method.
Note:
If the user can not view the ratio of load inertia to motor inertia (J_load / J_motor) under JOG operation (P4-05), press MODE key twice and then the ratio of load inertia to motor inertia (J_load / J_motor) will show on the display. If the user desire to perform JOG operation again, please press MODE key --> SET key --> SET key.

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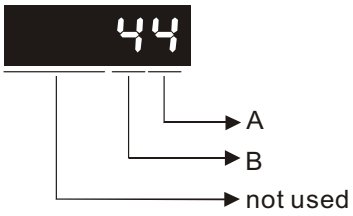
5-6-3 Easy Mode Tuning Flowchart

P2-31 Auto and Easy Mode Selection (Default setting: A=4)



In Easy Mode, the value “A” indicates the stiffness setting. When the setting value is higher, the control stiffness is also higher

Adjust P2-31: Increase the setting value of P2-31. Increase the value “A” to add the control stiffness or reduce the noise.

Adjust P2-25: According to the setting value of P2-31 add and adjust the control stiffness.

Continuously adjust until the satisfactory performance is achieved, and then the tuning is completed.

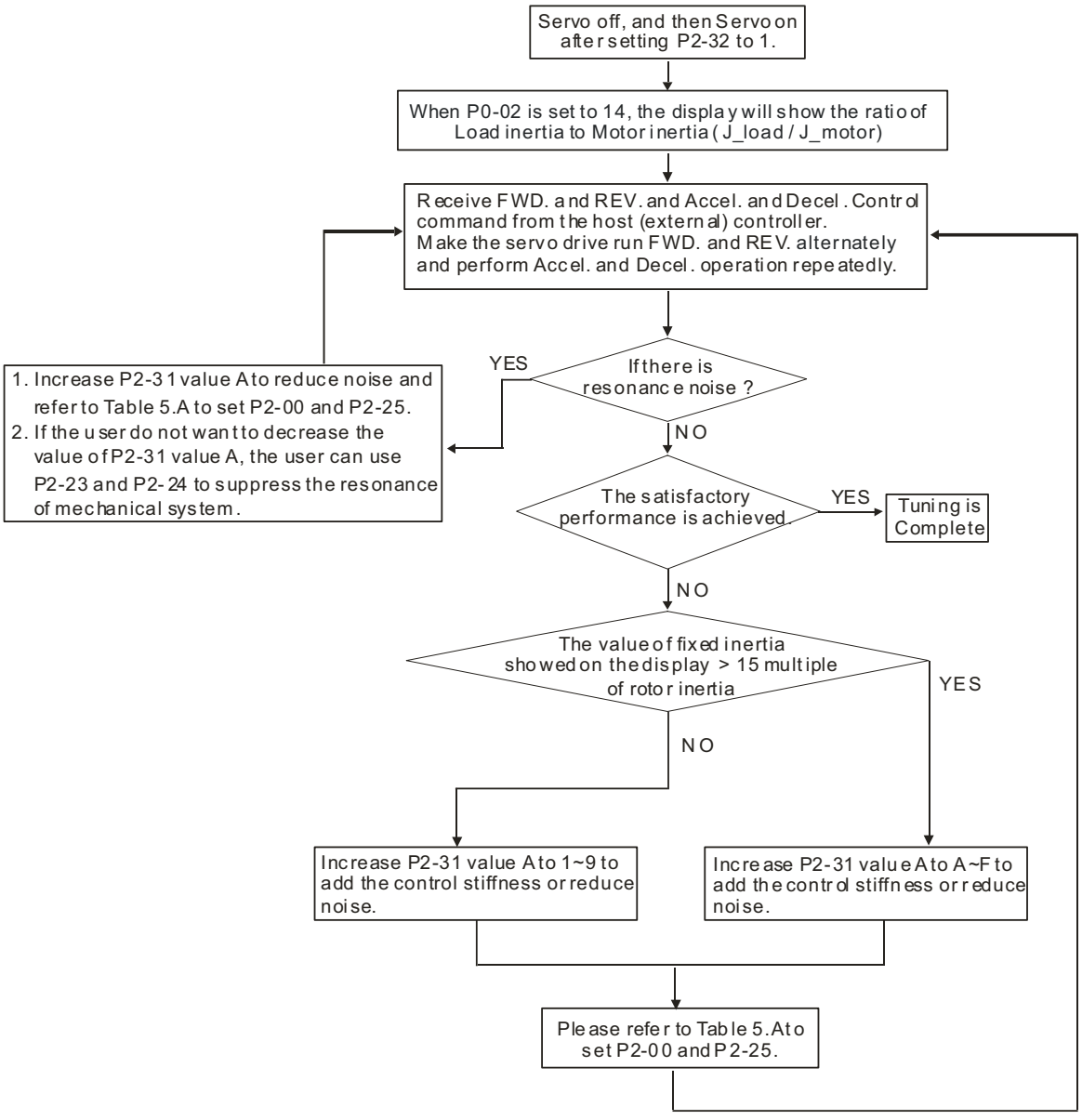

Servo off, and then Servo on after setting P2-32 to 1.
When P0-02 is set to 14, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
Receive FWD. and REV. and Accel. and Decel. Control command from the host (external) controller. Make the servo drive run FWD. and REV. alternately and perform Accel. and Decel. operation repeatedly.
If there is resonance noise ?
YES
NO
1. Increase P2-31 value A to reduce noise and refer to Table 5.A to set P2-00 and P2-25.
2. If the user do not want to decrease the value of P2-31 value A, the user can use P2-23 and P2-24 to suppress the resonance of mechanical system.
The satisfactory performance is achieved
YES
Tuning is Complete
NO
The value of fixed inertia showed on the display > 15 multiple of rotor inertia
YES
NO
Increase P2-31 value A to 1~9 to add the control stiffness or reduce noise.
Increase P2-31 value A to A~F to add the control stiffness or reduce noise.
Please refer to Table 5.A to set P2-00 and P2-25.

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Table 5.A Stiffness Setting in Easy Mode (P2-31 value “A”) and the setting of P2-00, P2-25

	Level (P2-31 Value A)	Load Range (J_load /J_motor)	Max. Load Corresponding Responsiveness	KPP (P2-00)	NLP (P2-25)	Remark
Low Responsiveness Level	1	50~100	5Hz	5	50	The setting of P2-00 and P2-25 must be inputted manually
	2	30~50	8Hz	8	31	
	3	20~30	11Hz	11	33	
	4	16~20	15Hz	15	16	
Medium Responsiveness Level	5	12~16	20Hz	20	12	The setting of P2-00 and P2-25 must be inputted manually
	6	8~12	27Hz	27	9	
	7	5~8	40Hz	40	6	
	8	2~5	60Hz	60	4	
	9	0~2	115Hz	115	2	
High Responsiveness Level	A	0~2	127Hz	127	1	The setting of P2-00 and P2-25 must be inputted manually
	B	2~8	103Hz	103	2	
	C	8~15	76Hz	76	3	
	D	15~25	62Hz	62	4	
	E	25~50	45Hz	45	5	
	F	50~100	36Hz	36	6	

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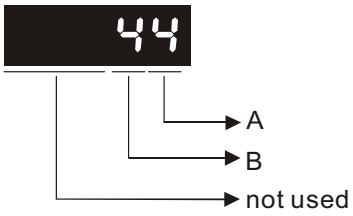
5-6-4 AutoMode (PI) Tuning Flowchart

P2-31 Auto and Easy Mode Selection (Default setting: B=4)



In AutoMode (PI), the value “B” indicates the responsiveness setting. When the setting value is higher, the responsiveness is faster.

Adjust P2-31: Increase the setting value of P2-31. Increase the value “B” to speed the responsiveness or reduce the noise.

Adjust P2-25: According to the setting value of P2-31 speed and adjust the responsiveness.

Continuously adjust until the satisfactory performance is achieved, and then the tuning is completed.

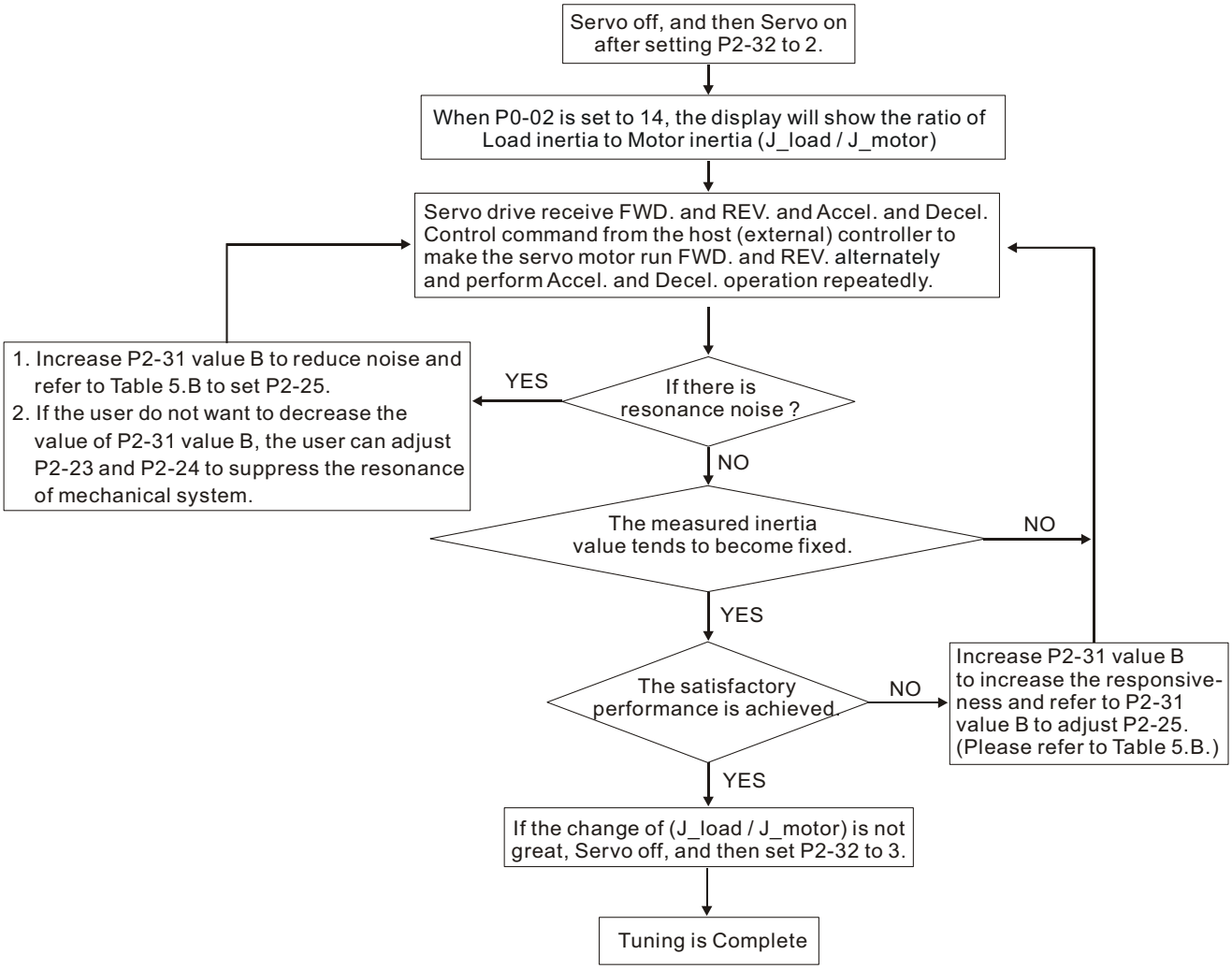

Servo off, and then Servo on after setting P2-32 to 2.
When P0-02 is set to 14, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
Servo drive receive FWD. and REV. and Accel. and Decel. Control command from the host (external) controller to make the servo motor run FWD. and REV. alternately and perform Accel. and Decel. operation repeatedly.
If there is resonance noise ?
YES
1. Increase P2-31 value B to reduce noise and refer to Table 5.B to set P2-25.
2. If the user do not want to decrease the value of P2-31 value B, the user can adjust P2-23 and P2-24 to suppress the resonance of mechanical system.
NO
The measured inertia value tends to become fixed.
NO
YES
The satisfactory performance is achieved.
NO
Increase P2-31 value B to increase the responsive-ness and refer to P2-31 value B to adjust P2-25. (Please refer to Table 5.B.)
YES
If the change of (J_load / J_motor) is not great, Servo off, and then set P2-32 to 3.
Tuning is Complete

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Table 5.B P2-31 Value “B” Setting in AutoMode (PI) and the setting of P2-00, P2-25

P2-31 value “B”	Speed Loop Responsive	Recommended Setting Value of P2-25
0	20Hz	13
1	30Hz	9
2	40Hz	6
3	60Hz	4
4	85Hz	3
5	120Hz	3
6	160Hz	2
7	200Hz	1
8	250Hz	1
9 and above	300Hz	0

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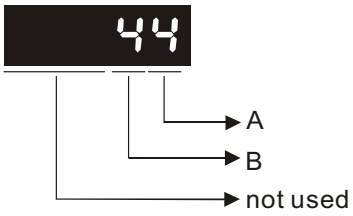
5-6-5 AutoMode (PDFF) Tuning Flowchart

P2-31 Auto and Easy Mode Selection (Default setting: B=4)



In AutoMode (PDFF), the value “B” indicates the responsiveness setting. When the setting value is higher, the responsiveness is faster.

Adjust P2-31: Increase the setting value of P2-31. Increase the value “B” to speed the responsiveness or reduce the noise.

Continuously adjust until the satisfactory performance is achieved, and then the tuning is completed.

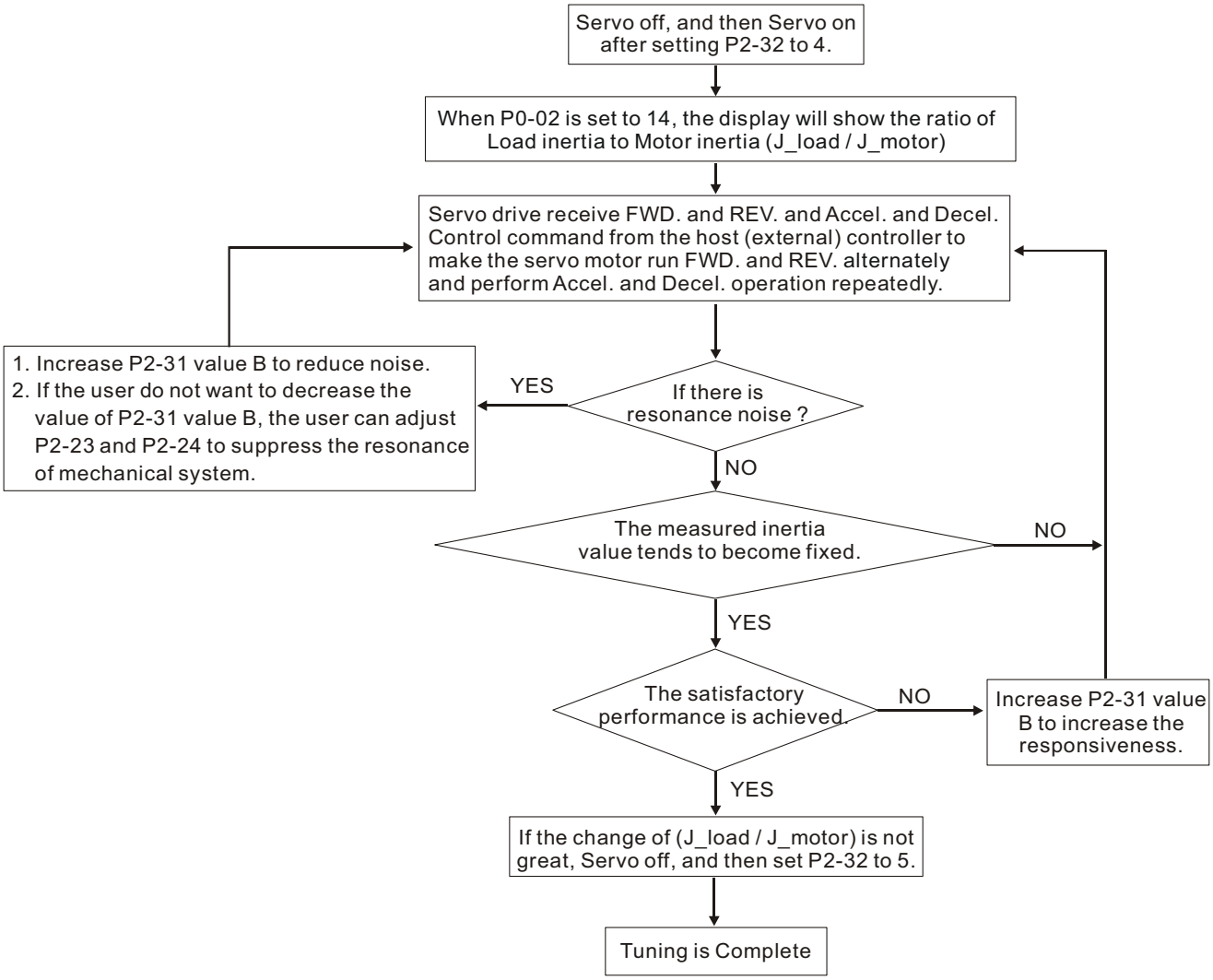

Servo off, and then Servo on after setting P2-32 to 4.
When P0-02 is set to 14, the display will show the ratio of Load inertia to Motor inertia (J_load / J_motor)
Servo drive receive FWD. and REV. and Accel. and Decel. Control command from the host (external) controller to make the servo motor run FWD. and REV. alternately and perform Accel. and Decel. operation repeatedly.
1. Increase P2-31 value B to reduce noise.
2. If the user do not want to decrease the value of P2-31 value B, the user can adjust P2-23 and P2-24 to suppress the resonance of mechanical system.
YES
If there is resonance noise ?
NO
The measured inertia value tends to become fixed.
NO
YES
The satisfactory performance is achieved.
NO
Increase P2-31 value B to increase the responsiveness.
YES
If the change of (J_load / J_motor) is not great, Servo off, and then set P2-32 to 5.
Tuning is Complete

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Table 5.C P2-31 Value “B” Setting in AutoMode (PDFF) and the Speed Loop Responsiveness.

P2-31 value “B”	Speed Loop Responsiveness	P2-31 value “B”	Speed Loop Responsiveness
0	20HZ	8	120Hz
1	30 HZ	9	140HZ
2	40 HZ	A	160HZ
3	50 HZ	B	180HZ
4	60 HZ	C	200Hz
5	70 Hz	D	220Hz
6	80Hz	E	260Hz
7	100Hz	F	300HZ

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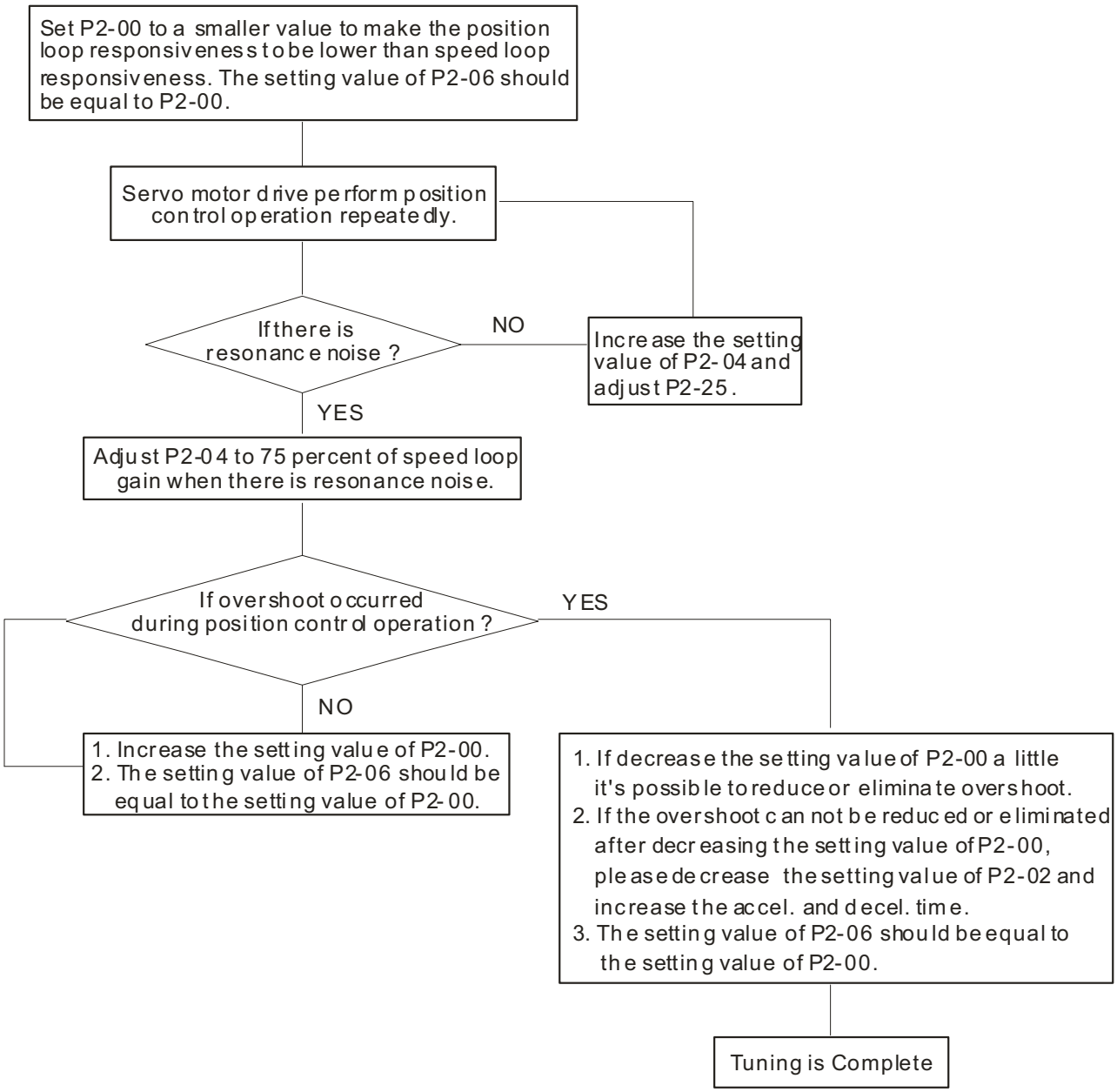
5-6-6 Manual Mode Tuning Flowchart

Position Mode


Set P2-00 to a smaller value to make the position loop responsiveness to be lower than speed loop responsiveness. The setting value of P2-06 should be equal to P2-00.
Servo motor drive perform position control operation repeatedly.
If there is resonance noise ?
NO
Increase the setting value of P2-04 and adjust P2-25.
YES
Adjust P2-04 to 75 percent of speed loop gain when there is resonance noise.
If overshoot occurred during position control operation ?
YES
NO
1. Increase the setting value of P2-00.
2. The setting value of P2-06 should be equal to the setting value of P2-00.
1. If decrease the setting value of P2-00 a little it's possible to reduce or eliminate overshoot.
2. If the overshoot can not be reduced or eliminated after decreasing the setting value of P2-00, please decrease the setting value of P2-02 and increase the accel. and decel. time.
3. The setting value of P2-06 should be equal to the setting value of P2-00.
Tuning is Complete

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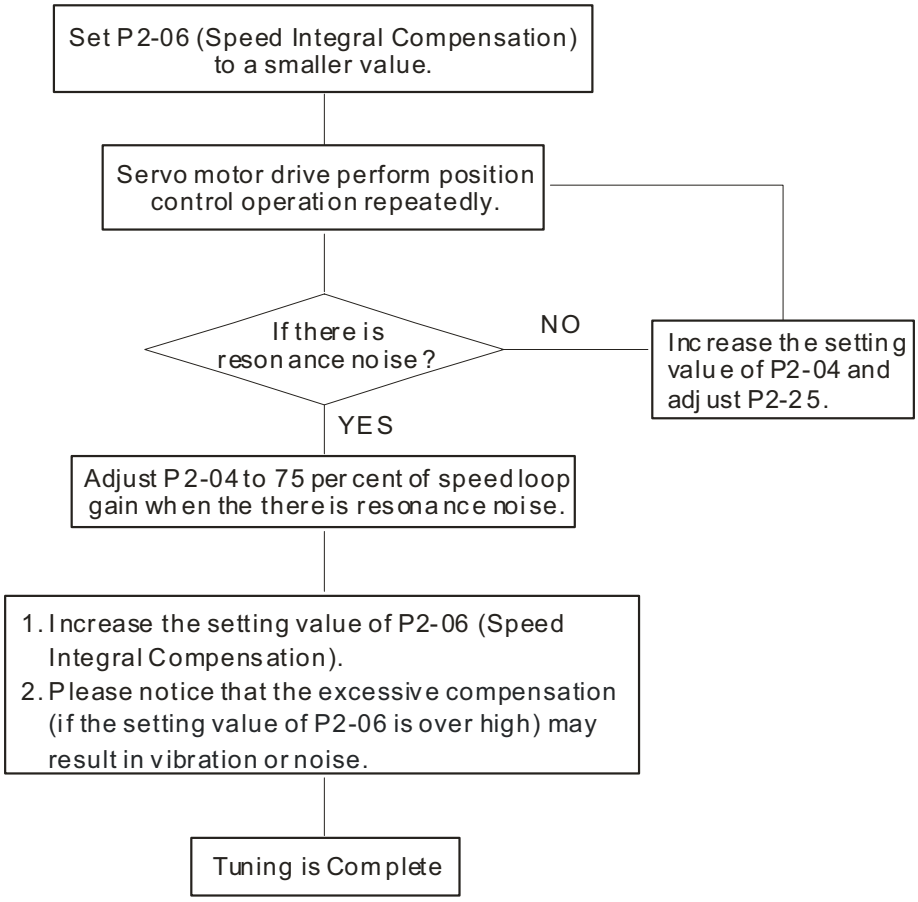
Speed Mode


Set P2-06 (Speed Integral Compensation) to a smaller value.
Servo motor drive perform position control operation repeatedly.
If there is resonance noise?
NO
Increase the setting value of P2-04 and adjust P2-25.
YES
Adjust P2-04 to 75 per cent of speed loop gain when the there is resonance noise.
1. Increase the setting value of P2-06 (Speed Integral Compensation).
2. Please notice that the excessive compensation (if the setting value of P2-06 is over high) may result in vibration or noise.
Tuning is Complete

5-6-7 Limit of Load Inertia Estimation

The accel. / decel. time for reaching 2000RPM must be below 1 second. The rotation speed must be above 200RPM. The load inertia must be 100 multiple or less of motor inertia. The change of external force and the inertia ratio can not be too much. In AutoMode (P2-32 is set to 3 or 5), it will stop estimating the load inertia. The measured load inertia value will not be saved when the power is cut off. When re-apply the power to the drive every time, the setting value of P1-37 is equal to the initial value of load inertia value. But, the measured inertia value will be memorized in P1-37 automatically when:

(1) Switching AutoMode #2 to AutoMode #3

(2) Switching AutoMode #4 to AutoMode #5

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5-6-8 Relationship between Tuning Modes and Parameters

Tuning Mode	P2-32	AutoSet Parameter	User-defined Parameter	Gain Value
Manual Mode	0(Default setting)	None	P2-00 (Proportional Position Loop Gain) P2-04 (Proportional Speed Loop Gain) P2-06 (Speed Integral Compensation) P2-25 (Low-pass Filter Time Constant of Resonance Suppression)	Fixed
Easy Mode	1	P2-04 P2-06 P2-26	P2-31 Value A (Level of Stiffness) P2-00 (Proportional Position Loop Gain) P2-25 (Low-pass Filter Time Constant of Resonance Suppression)	Fixed
AutoMode (PI) [Continuous]	2	P2-00, P2-04, P2-06,	P2-31 Value B (Level of Responsiveness) P2-25 (Low-pass Filter Time Constant of Resonance Suppression)	Continuous Adjusting
AutoMode (PI) [Fixed Inertia] (The inertia ratio is determined by P1-37)	3	P2-00 P2-04 P2-06	P1-37 (Ratio of Load Inertia to Servo Motor Inertia [J_load / J_motor]) P2-31 Value B (Level of Responsiveness) P2-25 (Low-pass Filter Time Constant of Resonance Suppression)	Fixed
AutoMode (PDFF) [Continuous]	4	P2-00, P2-04, P2-06, P2-25, P2-26	P2-31 Value B (Level of Responsiveness)	Continuous Adjusting
AutoMode (PDFF) [Fixed Inertia] (The inertia ratio is determined by P1-37)	5	P2-00, P2-04, P2-06, P2-25, P2-26,	P1-37 (Ratio of Load Inertia to Servo Motor Inertia [J_load / J_motor]) P2-31 Value B (Level of Responsiveness)	Fixed

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5-6-9 Gain Adjustment in Manual Mode

The position and speed responsiveness selection is depending on and determined by the the control stiffness of machinery and conditions of applications. Generally, high reponsiveness is essential for the high frequency positioning control of mechanical facilities and the applications of high precision process system. However, the higher responsiveness may easily result in the resonance of machinery system. Therefore, for the applications of high responsiveness, the machinery system with control stiffness is needed to avoid the resonance. Especially when adjusting the responsiveness of unfamiliar machinery system, the user can gradually increase the gain setting value to improve responsiveness untill the resonance occurs, and then decrease the gain setting value. The relevant parameters and gain adjusting methods are described as follows:

- KPP, Parameter P2-00 Proportional Position Loop Gain
  This parameter is used to determine the responsiveness of position loop (position loop gain). It could be used to increase stiffness, expedite position loop response and reduce position error. When the setting value of KPP is higher, the response to the position command is quicker, the position error is less and the settling time is also shorter. However, if the setting value is over high, the machinery system may generate vibration or noise, or even overshoot during positioning. The position loop responsiveness is calculated as follows:

  $$\text{Position Loop Responsiveness (Hz)} = \frac{KPP}{2\pi}$$

- KVP, Parameter P2-04 Proportional Speed Loop Gain
  This parameter is used to determine the responsiveness of speed loop (speed loop gain). It could be used to expedite speed loop response. When the setting value of KVP is higher, the response to the speed command is quicker. However, if the setting value is over high, it may result in the resonance of machinery system. The responsiveness of speed loop must be higher than the 4~6 times of the responsiveness of position loop. If responsiveness of position loop is higher than the responsiveness of speed loop, the machinery system may generate vibration or noise, or even overshoot during positioning. The speed loop responsiveness is calculated as follows:

  $$\text{Speed Loop Responsiveness (Hz)} = \frac{KVP}{(1+(J\_load / J\_motor))\ X2\pi}$$

- KVI, Parameter P2-06 Speed Integral Compensation
  If the setting value of KVI is higher, the capability of decreasing the speed control deviation is better. However, if the setting value is over high, it may easily result in the vibration of machinery system. The recommended setting value is as follows:

  $$\text{KVI (Parameter P2-06)} \leq 1.5 \times \text{Speed Loop Responsiveness}$$

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- NLP, Parameter P2-25 Low-pass Filter Time Constant of Resonance Suppression

  When the value of (J_load / J_motor) is high, the responsiveness of speed loop may decrease. At this time, the user can increase the setting value of KVP (P2-04) to keep the responsiveness of speed loop. However, when increasing the setting value of KVP (P2-04), it may easily result in the vibration of machinery system. Please use this parameter to suppress or eliminate the noise of resonance. If the setting value of NLP is higher, the capability of improving the noise of resonance is better. However, if the setting value is over high, it may easily lead to the instability of speed loop and overshoot of machinery system.

  The recommended setting value is as follows:

$$\text{NLP (Parameter P2-25)} \leq \frac{1000}{4 \times \text{Speed Loop Responsiveness (Hz)}}$$

- DST, Parameter P2-26 External Anti-Interference Gain

  This parameter is used to enhance the anti-interference capability and reduce the occurrence of overshoot. The default setting is 0 (Disabled). It is not recommended to use it in manual mode only when performing a few tuning on the value gotten through P2-32 AutoMode (PDFF) (setting value is 5, mode 5) automatically (The setting value of P2-26 will change to the value that measured in mode 5 (AutoMode (PDFF)) when switching mode 5 ((AutoMode (PDFF)) to mode 0 (Manual mode)).

- PFG, Parameter P2-02 Position Feed Forward Gain

  This parameter is used to reduce position error and shorten the positioning settling time. However, if the setting value is over high, it may easily lead to the overshoot of machinery system. If the value of electronic gear ratio (1-44 /1-45) is over than 10, the machinery system may also easily generate vibration or noise.

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Chapter 6 Control Modes of Operation

6-1 Control Modes of Operation

The Delta Servo can be programmed to provide six single and five dual modes of operation. Their operation and description is listed in the following table.

Mode		Code	Description
Single Mode	External Position Control	Pt	Position control for the servo motor is achieved via an external pulse command.
	Internal Position Control	Pr	Position control for the servo motor is achieved via by 8 commands stored within the servo controller. Execution of the 8 positions is via Digital Input (DI) signals.
	Speed Control	S	Speed control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command. Control of the internal speed parameters is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Speed Control	Sz	Speed control for the servo motor is only achieved via parameters set within the controller. Control of the internal speed parameters is via the Digital Inputs (DI). (A maximum of three speeds can be stored internally).
	Torque Control	T	Torque control for the servo motor can be achieved via parameters set within the controller or from an external analog -10 ~ +10 Vdc command. Control of the internal torque parameters is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
	Torque Control	Tz	Torque control for the servo motor is only achieved via parameters set within the controller. Control of the internal torque parameters is via the Digital Inputs (DI). (A maximum of three torque levels can be stored internally).
Dual Mode		Pt-S	Either Pt or S control mode can be selected via the Digital Inputs (DI)
		Pt-T	Either Pt or T control mode can be selected via the Digital Inputs (DI)
		Pr-S	Either Pr or S control mode can be selected via the Digital Inputs (DI)
		Pr-T	Either Pr or T control mode can be selected via the Digital Inputs (DI)
		S-T	Either S or T control mode can be selected via the Digital Inputs (DI)

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The steps of changing mode:

(1) Turn off the servo drive (the status of Servo Off) and turning SON signal of Digit input to be off can complete this action.
(2) Using parameter P1-01. (Refer to chapter 7).
(3) After the setting is completed, cut the power off and restart the drive again.

The following sections describe the operation of each control mode, including control structure, command source and loop gain adjustment, etc.

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6-2 Position Control Mode

The position control mode (Pt or Pr mode) is usually used on the applications of precision positioning, such as industry machine, etc. Delta servo drive supports two kinds of command sources in position control mode. One is external pulse train and the other is internal parameter. The external pulse train input with direction can control the rotation angle of servo motor. The max. input frequency is 500Kpps (Line Driver) and it is equal to rotation speed of 3000rpm.

In order to provide more convenient position control function, Delta servo drive provides eight internal parameters for position control. There are two usage of internal parameters, one is to set different position command into these eight internal parameters before operation and then use POS0~POS2 of DI signals of CN1 to perform positioning control. The other is to use serial communication to change the setting value of these eight internal parameters.

Beside, in order to make the servo motor and load can be operate more smoothly, Delta servo drive also provide complete Position Spine Line (P-curve) profile for position control mode. In position close loop, users need to set not only speed control parameter but also position loop gain and feed forward compensation parameters. Users also can select one of three turning mode (Manual/Auto/ Easy) to perform gain adjustment. This Chapter 6 mainly describes the applicability of loop gain adjustment, feed forward compensation and tuning technology of Delta servo system.

Position control mode includes Position (Pt) control mode and Position (Pr) control mode. The command source of Pt mode is external pulse train and the command source of Pr mode is internal parameters (P1-15 to P1-30).

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6-2-1 Command Source of Position (Pt) Control Mode

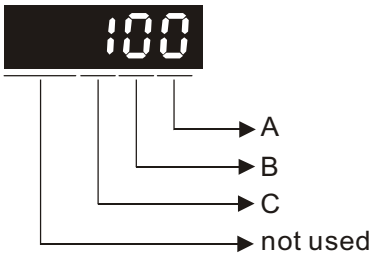
The command source of Pt mode is external pulse train input form terminals. There are three types of pulse input and each pulse type is with polarity (positive (+), negative (-)). They all can be set in parameter P1-00. Please refer to the following:

P1 - 00▲	PTT	External Pulse Input Type	Communication Addr.: 0100H

Default: 2 Applicable Control Mode: P

Range: 0~132

Setting:



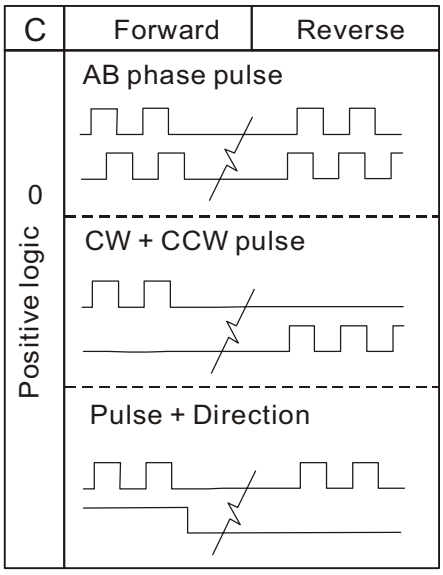
Value A: pulse type

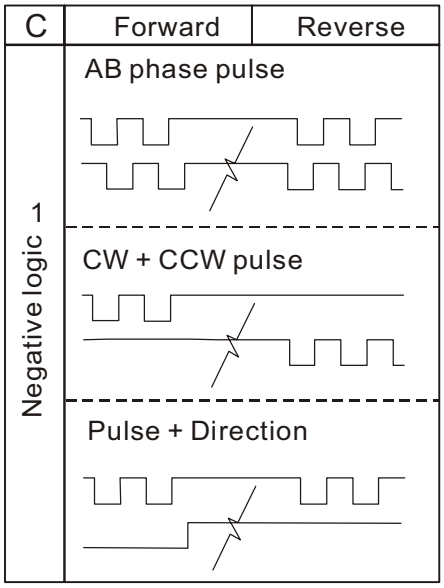
- A=0: AB phase pulse (4x)
  A=1: CW + CCW pulse
  A=2: Pulse + Direction
- Other setting: Reversed

Reserved setting value of B: 0

Value C: Logic type

Input pulse interface	Max. Input pulse frequency
Line driver	500kpps
Open collector	200kpps





Position pulse can be input from these terminals, PULSE (41), /PULSE (43) and SIGN (37), /SIGN (36). It can be an open-collector circuit or line driver circuit. For the detail wiring, please refer to 3-6-1.

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6-2-2 Command Source of Position (Pr) Control Mode

The command sources of Pr mode are P1-15, P1-16 to P1-29, P1-30 these eight built-in parameters. According to parameter P1-33, users can select: a) Absolute or b) Incremental position control. Using with external I/O signals (CN1, POS0 to POS 2 and CTRG) can select one of the eight built-in parameters to be position command. Please refer to the table below:

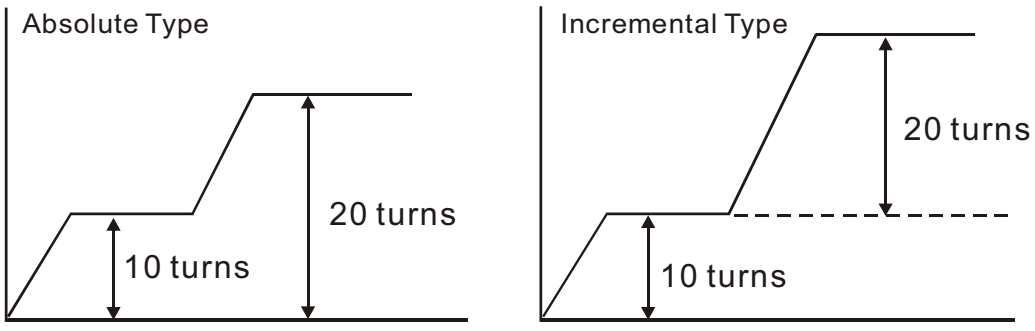
Position Command	POS2	POS1	POS0	CTRG	Parameters	Description
P1	0	0	0	↑	P1-15	Rotation number (+/- 30000)
					P1-16	Pulses (+/- max cnt)
P2	0	0	1	↑	P1-17	Rotation number (+/- 30000)
					P1-18	Pulses (+/- max cnt)
P3	0	1	0	↑	P1-19	Rotation number (+/- 30000)
					P1-20	Pulses (+/- max cnt)
P4	0	1	1	↑	P1-21	Rotation number (+/- 30000)
					P1-22	Pulses (+/- max cnt)
P5	1	0	0	↑	P1-23	Rotation number (+/- 30000)
					P1-24	Pulses (+/- max cnt)
P6	1	0	1	↑	P1-25	Rotation number (+/- 30000)
					P1-26	Pulses (+/- max cnt)
P7	1	1	0	↑	P1-27	Rotation number (+/- 30000)
					P1-28	Pulses (+/- max cnt)
P8	1	1	1	↑	P1-29	Rotation number (+/- 30000)
					P1-30	Pulses (+/- max cnt)

State of POS0~2: 0 indicates the contact is OFF (Normally Open)

1 indicates the contact is ON (Normally Closed)

CTRG↑: the instant time when the contact changes from 0 (open) to 1 (closed).

The application of absolute and incremental position control is various and multiple. This kind of position control is equal to a simple sequence control. User can easily complete the cycle running by using the above table. For example, the position command, P1 is 10 running and P2 is 20 running. Give the position command P1 first and then give the position command P2. The difference between absolute and incremental position control is shown as the figure below:



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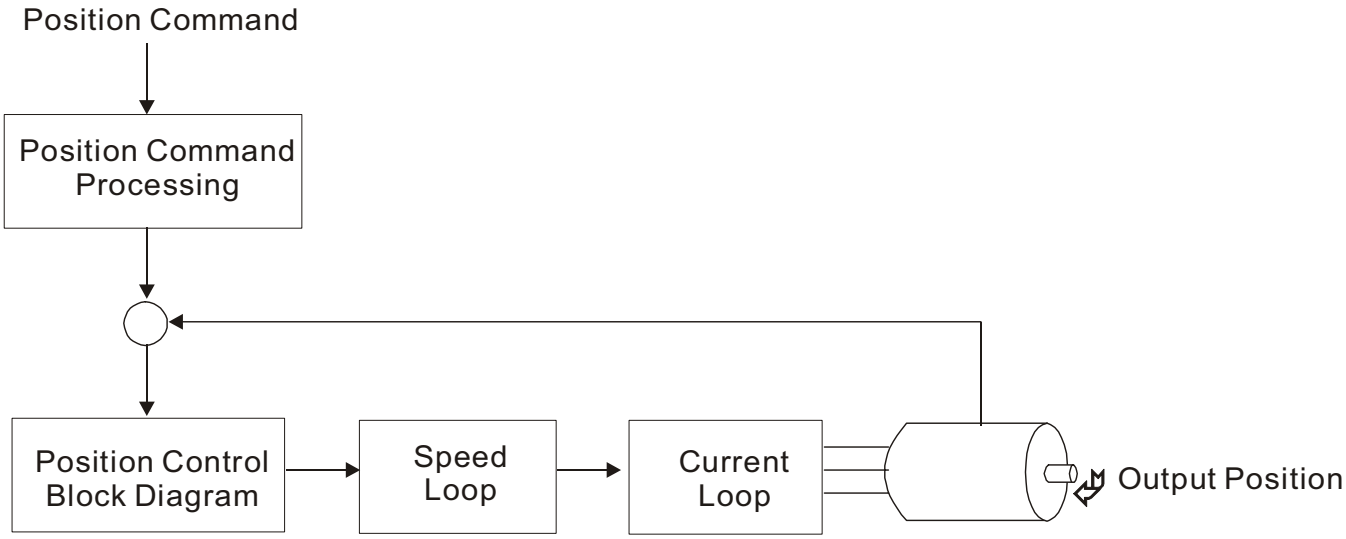
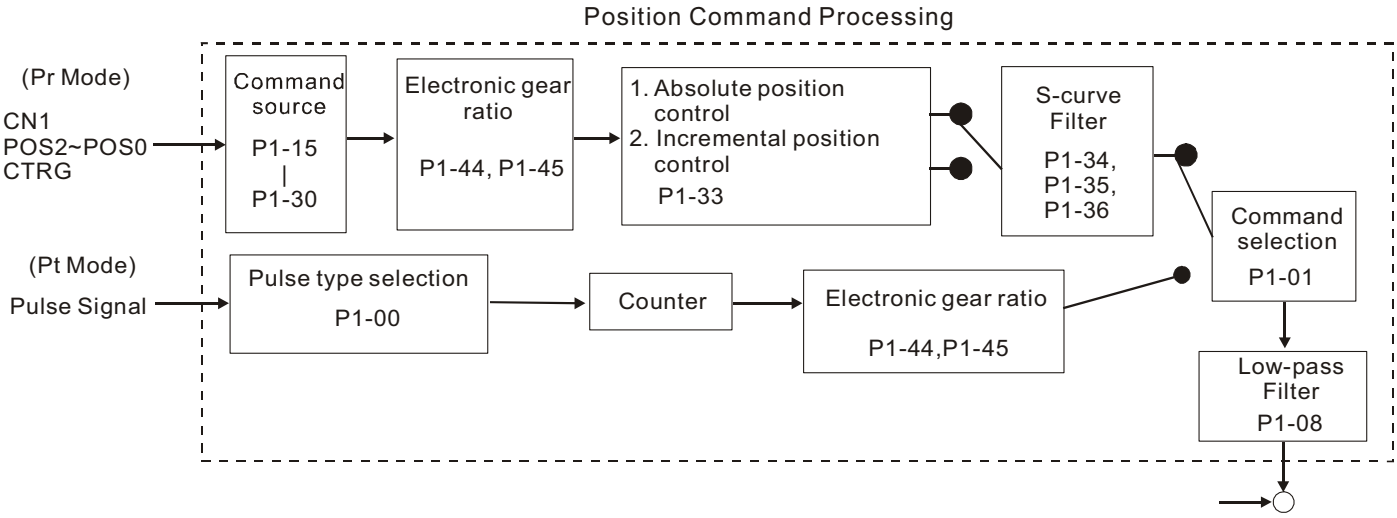
6-2-3 Structure of Position Control Mode

Basic Structure:



In order to pursue the goal of perfection in position control, the pulse signal should be modified through position command processing and the structure is shown as the figure below:



Using parameter can select Pr mode and Pt mode. Electronic gear ratio can be set in both two modes to set proper position revolution. ASDA-A series servo drive also provides P-curve and low-pass filter, which are used whenever the motor and load need to be operated more smoothly. As for the information of electronic gear ratio, P-curve and low-pass filter, please refer to the following sections.

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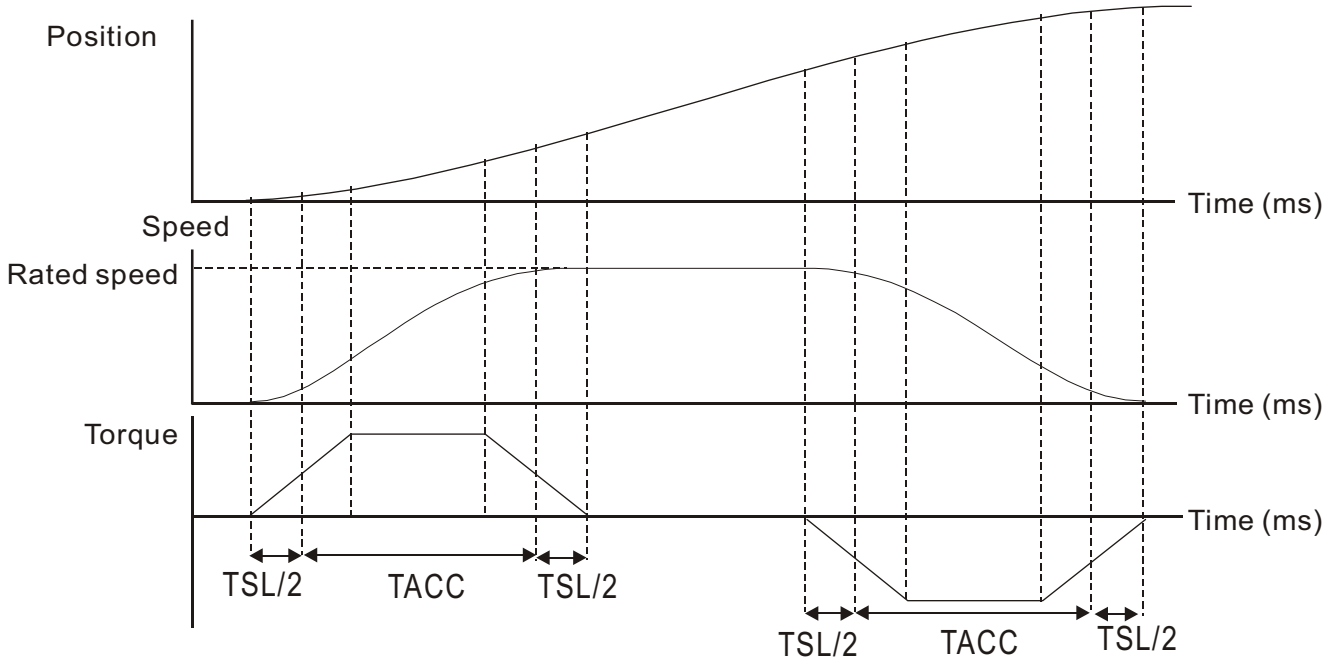
6-2-4 P-curve Filter for Position Control

The P-curve filter is for the position smoothing of motion command. Using P-curve filter can run the servo motor more smoothly in response to a sudden position command. Since the speed and acceleration curve are both continuous and the time for the servo motor to accelerate is short, using P-curve filter not only can improve the performance when servo motor accelerate or decelerate but also can make motor to operate more smoothly (from mechanical view). When the load is change, the motor usually run not smoothly when starts to run and stop due to the friction and inertia change. At this moment, users can increase Accel/Decel P-curve constant (TSL), Accel time constant (TACC) and Decel time constant (TDEC) to improve the performance. Because the speed and angle acceleration are continuous when position command is changed to pulse signal input, so it is not needed to use P-curve filter.



P-curve characteristics and Time relationship (Acceleration)

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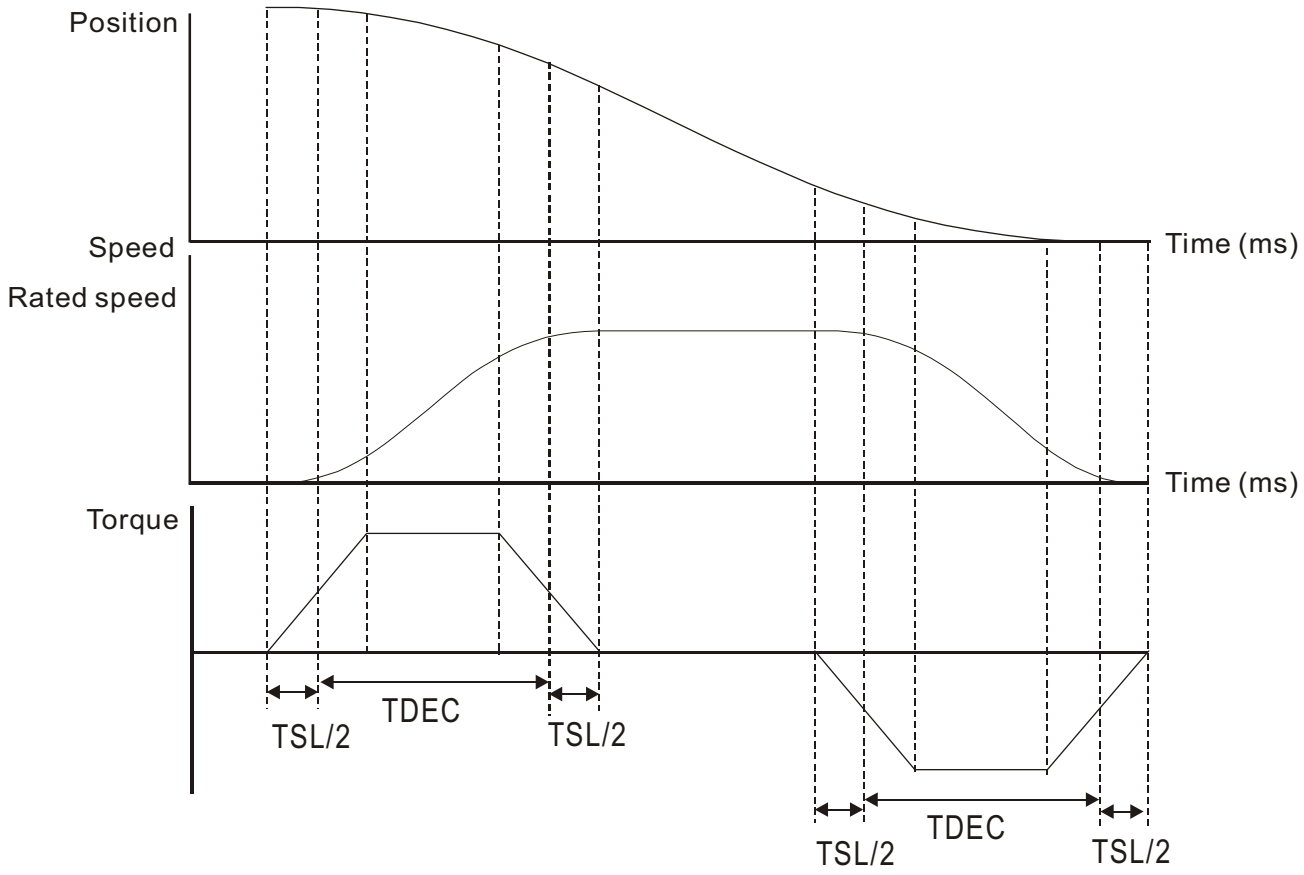

P-curve characteristics and Time relationship (Deceleration)

Relevant parameters:

P1 - 34	TACC	Acceleration Time	Communication Addr.: 0122H

Default: 200 Applicable Control Mode: P/S

Range: 1~20000

Unit: msec

P1 - 35	TDEC	Deceleration Time	Communication Addr.: 0123H

Default: 200 Applicable Control Mode: Pr/S

Range: 1~20000

Unit: msec

P1 - 36	TSL	Accel /Decel S-curve	Communication Addr.: 0124H

Default: 0 Applicable Control Mode: P/S

Range: 0~10000 (0: disabled)

Unit: msec

📖 Note: If the setting value of parameter P1-36 is set to 0, it indicates Accel / Decel S-curve function is disabled and the command is just By-Pass.

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6-2-5 Electronic Gear Ratio

Relevant parameters:

P1 - 44▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	Communication Addr.: 012CH

Default: 1 Applicable Control Mode: P

Range: 1~32767

Unit: Pulse

P1 - 45▲	GR2	Electronic Gear Ratio (Denominator)	Communication Addr.: 012DH

Default: 1 Applicable Control Mode: P

Range: 1~32767

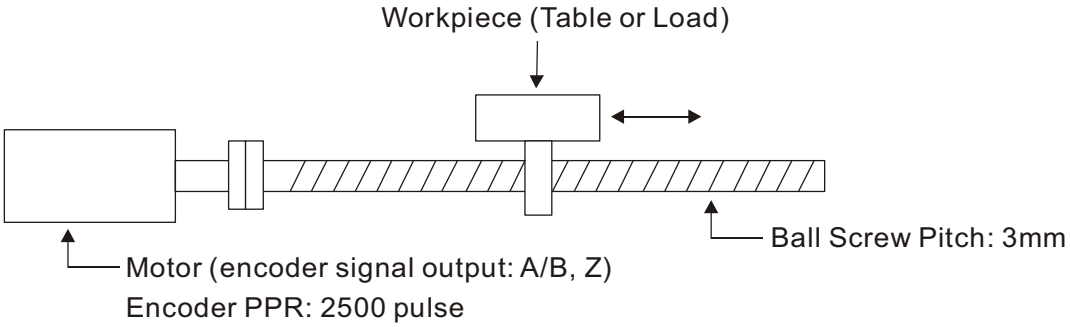
Unit: Pulse

$$\text{Electronic gear ratio}=\left(\frac{N1}{M}\right)=\frac{P1\text{-}44}{P1\text{-}45}\text{, the electronic gear setting range should be}\ \frac{1}{50}\le\left(\frac{N1}{M}\right)\le 200$$

The electronic gear function provides easy travel distance ratio change. It can enable the servo motor travel distance per input reference pulse to be set to any value. It also allows the pulses that may be generated by the external controller to be used for control without considering the machine gear ratio or the numbers of encoder pulse. For example, if the electronic gear ratio is 0.5 and the encoder pulse per cycle is 10000ppr, the motor rotation pulse is 1 pulse (revolution).

For example, after the proper electronic gear ratio is set, the reference travel distance is 1 μm/pulse, it becomes easier to be used.

Travel distance per load shaft revolution = T



	Electronic gear ratio	Travel distance per load shaft revolution
When electronic gear function is Not Used	$=\frac{1}{1}$	$=\frac{3x1000}{4x2500}=\frac{3000}{10000}$ μm
When electronic gear function is Used	$=\frac{10000}{3000}$	=1 μm

6-2-6 Low-pass Filter

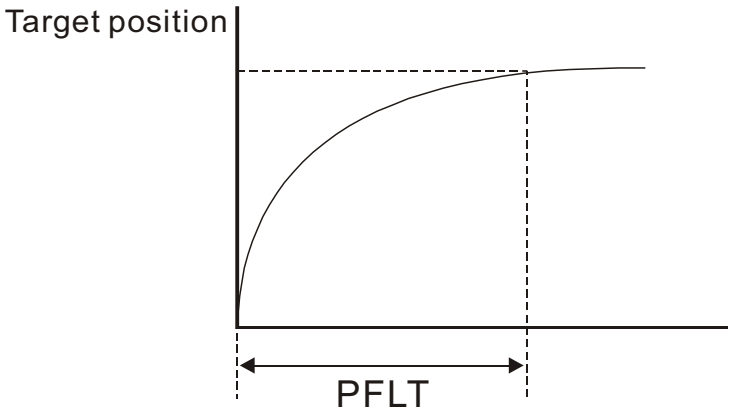
Relevant parameters:

P1 - 08	PFLT	Smooth Constant of Position Command (Low-pass filter)	Communication Addr.: 0108H

Default: 0 Applicable Control Mode: P

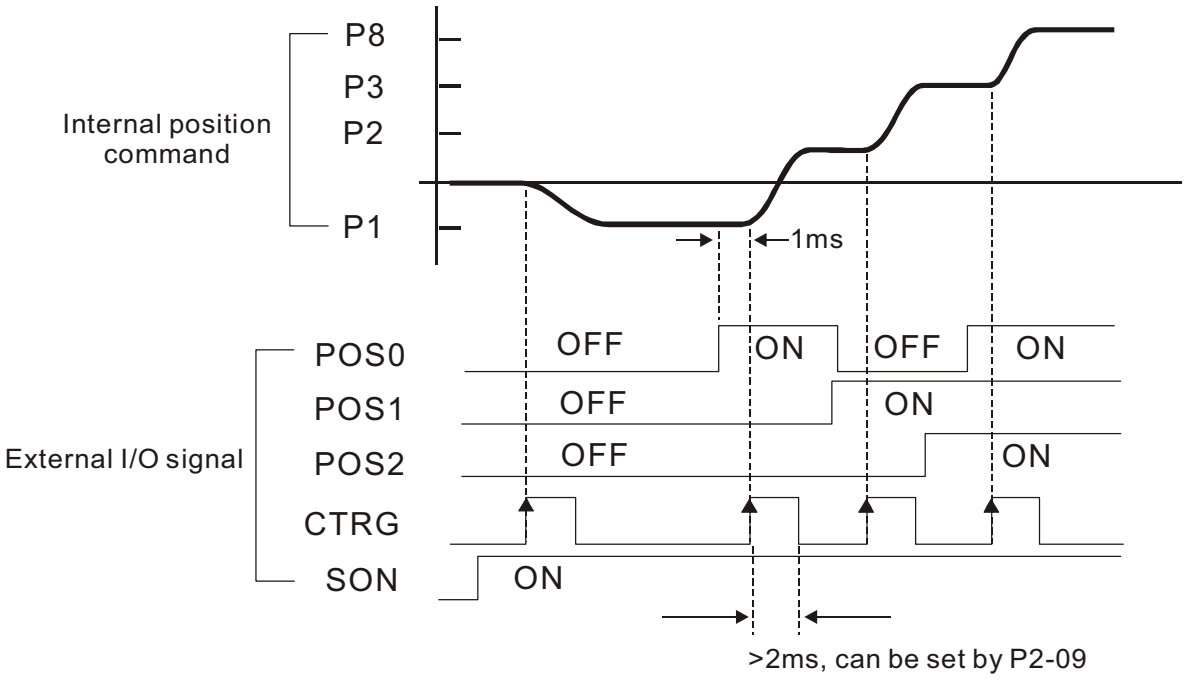
Range: 0~1000 (0: Disabled)

Unit: 10 msec



6-2-7 Timing Chart of Position (Pr) Control Mode

In Pr mode, position command source is DI signal from CN1, i.e. selected by POS0~POS2 and CTRG. Please refer to 6-2-2 to see the relationship between DI signals and parameters. The following figure is shown the timing chart of Pr mode:



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6-2-8 Position Loop Gain Adjustment

Before performing position control (setting position control block diagram), users should complete the speed control setting by selecting tuning mode (using parameter P-32) since the position loop contains speed loop. Then, adjust the proportional gain (parameter P2-00) and feed forward gain (parameter P2-02). Or using Auto mode to automatically adjust the gain of speed and position control mode.

1) Proportional gain: Adjust this gain can increase the response bandwidth of position loop.
2) Feed forward gain: Adjust this gain, the phase delay time during operation is nearly zero when the setting is close to 100%.

The bandwidth of position loop can not exceed the bandwidth of speed loop, it is recommended as $fp \le \frac{fv}{4}$,

fv : Response bandwidth of speed loop (Hz),

KPP = $2 \times \pi \times$ fp, in this formula, fp: Response bandwidth of position loop (Hz)

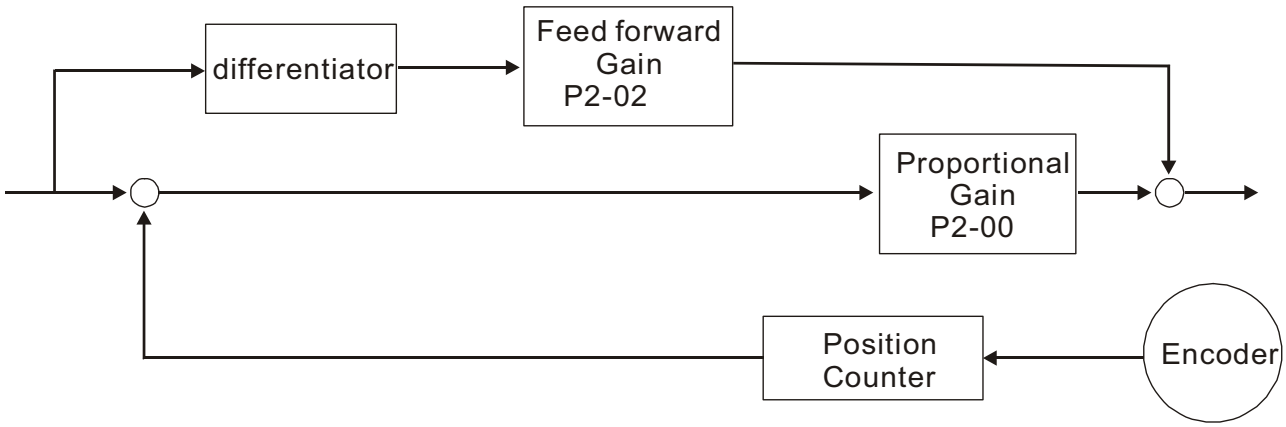
For example, the desired bandwidth is equal to 20 Hz =>KPP = $2 \times \pi \times 20 = 125$

Relevant parameters:

P2 - 00	KPP	Proportional Position Loop Gain	Communication Addr.: 0200H
	Default: 35		Applicable Control Mode: P
	Range: 0~1023		
	Unit: rad/s		

P2 - 02	PFG	Position Feed Forward Gain	Communication Addr.: 0202H
	Default: 5000		Applicable Control Mode: P
	Range: 10~20000		
	Unit: 0.0001		

Position Control Block Diagram



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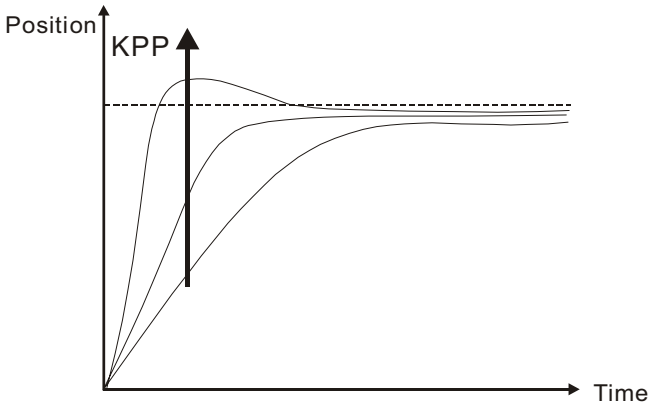
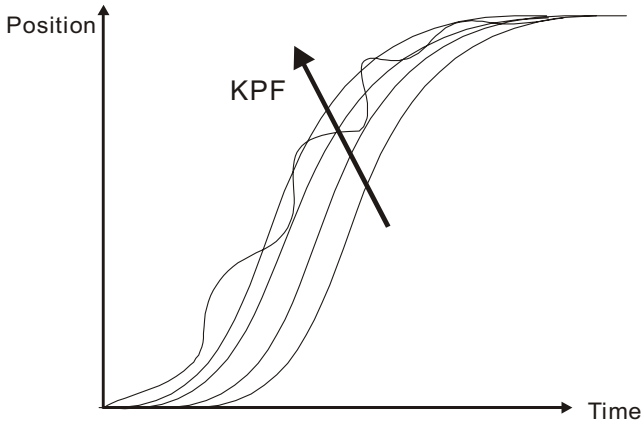
When the value of KPP is too great, the bandwidth of position loop is increase and it will result in small phase margin. At this time, the rotor of motor will shake and turn around. Users have to decrease the value of KPP until the rotor of motor coould not shake and turn around. When there is an external torque interrupted, over low KPP value cannot meet the requirement of reasonable position track error demand. Adjust feed forward gain (Using parameter P2-02 can efficiently decrease the dynamic position track error).





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6-3 Speed Control Mode

The speed control mode (S or Sz) is usually used on the applications of precision speed control, such as CNC machine, etc. Delta servo drive supports two kinds of command sources in speed control mode. One is external analog signal and the other is internal parameter. The external analog signal is from external voltage input and it can control the rotation speed of servo motor. There are two usage of internal parameter, one is set different speed command in three speed control parameter before operation and then using SP0 and SP1 of DI input of CN1 perform switching. The other usage is using serial communication to change the setting value of parameter.

Beside, in order to make the servo motor and load can be operate more smoothly, Delta servo drive also provide complete S-curve profile for speed control mode. In speed close loop, ASDA-A series servo drive provides gain adjustment and accumulation integrated PI controller. Also, ASDA-A series servo drive provides three modes of tuning technology (Manual/Auto/Easy) for users to select.

There are three turning modes for gain adjustment: Manual, Auto and Easy modes.

- **Manual Mode:** User-defined loop gain adjustment. When using this mode, all auto and auxiliary function will be disabled.
- **Auto Mode:** Continuous adjustment of loop gains according to measured inertia, with ten levels of system bandwidth. The parameter set by user is default value.
- **Easy Mode:** Robust for wide range of external load inertia change, with ten levels of system stiffness. Using easy mode can immediately suppress the interference of external load and mechanical resonance and also stand for the load inertia change.

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6-3-1 Command Source of Speed Control Mode

Speed command Source:

1. External analog signal: External analog voltage input, -10V to +10V
2. Internal parameter: P1-09 to P1-11

Speed Command	DI signal of CN1		Command Source			Content	Range
	SPD1	SPD0					
S1	0	0	Mode	S	External analog signal	Voltage between V-REF-GND	+/-10 V
				Sz	None	Speed command is 0	0
S2	0	1	Internal parameter			P1-09	0~5000 rpm
S3	1	0				P1-10	0~5000 rpm
S4	1	1				P1-11	0~5000 rpm

- **State of SPD0~1**:
  0: indicates OFF (Normally Open)
  1: indicates ON (Normally Closed)

- When **SPD0=SPD1=0 (OFF)**, if the control mode of operation is Sz, then the command is 0. Therefore, if users do not use analog voltage as speed command, users can choose Sz mode to operation speed control to avoid the zero point drift problem of analog voltage. If the control mode of operation is S, then the command is the analog voltage between **V-REF and GND.** The setting range of the input voltage is from -10V to +10V and the corresponding rotation speed is adjustable (see parameter P1-40).

- When one of **SPD0 and SPD1 is not 0 (OFF)**, the speed command is internal parameter. The command is valid (enabled) after **SPD0~1 is changed and it doesn't need that CTRG should be triggered.**

The speed command that is described in this section not only can be taken as speed command in speed control mode (S or Sz mode) but also can be the speed limit input command in torque control mode (T or Tz mode).

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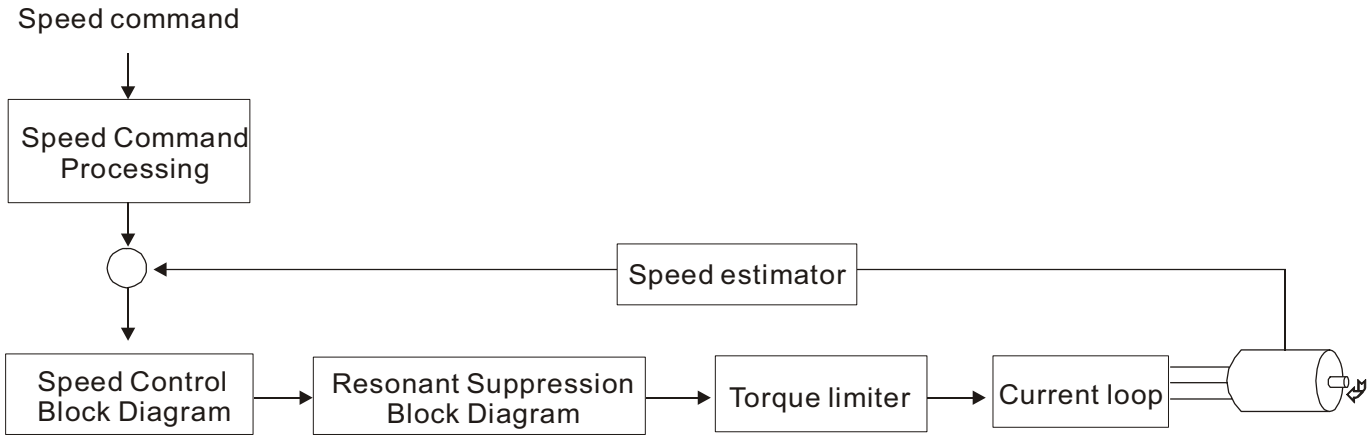
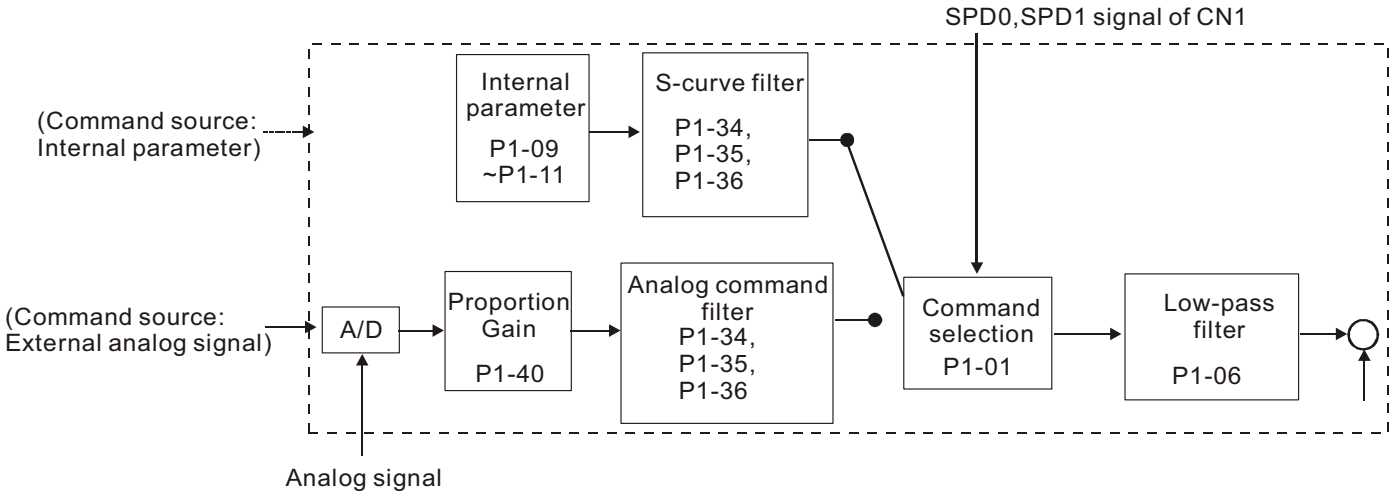
6-3-2 Structure of Speed Control Mode

Basic Structure:



In the above figure, the **speed command processing** is used to select the command source of speed control according to chapter 6-3-1, including max. rotation speed of analog speed command selection (parameter P1-40) and S-curve filter smoothing strategy of speed control. The **speed control block diagram** is used to manage the gain parameters of the servo drive and calculate the current input provided to motor instantaneously. The **resonance suppression block diagram** is used to suppress the resonance of mechanical system.

The function and structure of **speed command processing** is shown as the figure below:



The command source is selected according to the state of **SPD0, SPD1** and parameter P1-01 (S or Sz). Whenever the command signal needs to be more smoothly, we recommend users to use S-curve and low-pass filter.

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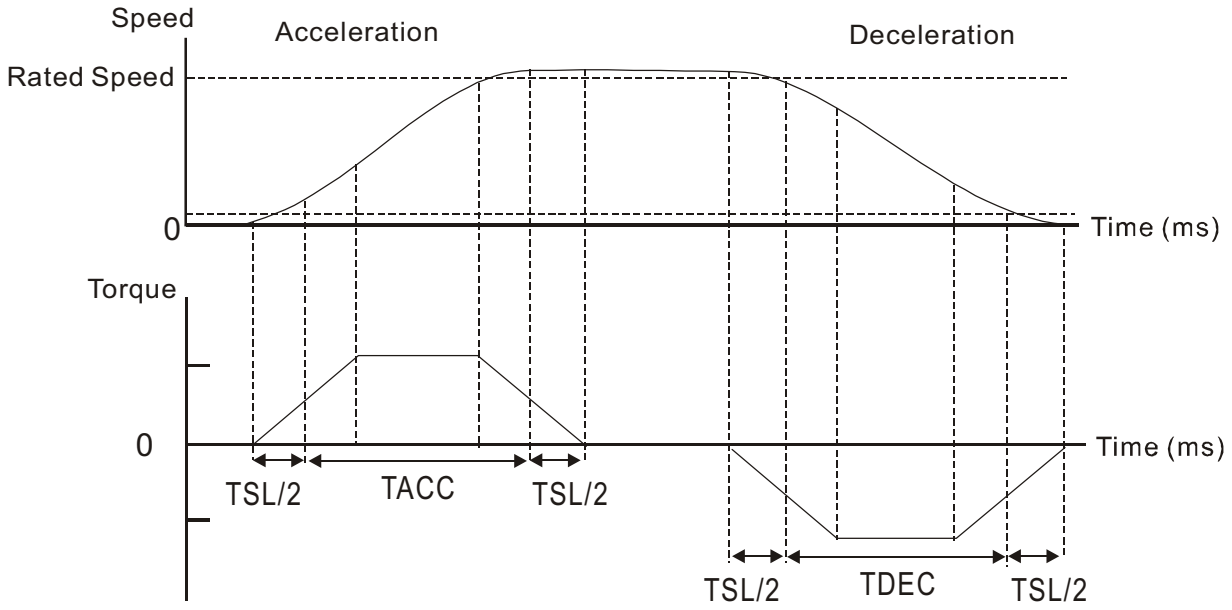
6-3-3 Smoothing Strategy of Speed Control Mode

S-curve Filter

The S-curve filter is for the speed smoothing of motion command which provides 3 steps accel S-curve smoothing strategy during acceleration and deceleration. Using S-curve filter can run the servo motor more smoothly in response to a sudden speed command. Since the speed and acceleration curve are both continuous, in order to avoid the mechanical resonance and noise may occur due to a sudden speed command (differentiation of acceleration), using S-curve filter not only can improve the performance when servo motor accelerate or decelerate but also can make motor to operate more smoothly (from mechanical view). When the load is change, the motor usually run not smoothly when starts to run and stop due to the friction and inertia change. At this moment, users can increase Accel/Decel S-curve constant (TSL), Accel time constant (TACC) and Decel time constant (TDEC) to improve the performance. ASDA-A series servo drive also support the time calculation of completing speed command. T (ms) is the operation (running) time. S (rpm) is absolute speed command, i.e. the absolute value (the result) after starting speed subtract final speed.



S-curve characteristics and Time relationship

Relevant parameters:

P1 - 34	TACC	Acceleration Time	Communication Addr.: 0122H
	Default: 200		Applicable Control Mode: P/S
	Range: 1~20000		
	Unit: msec		

P1 - 35	TDEC	Deceleration Time	Communication Addr.: 0123H
	Default: 200		Applicable Control Mode: Pr/S
	Range: 1~20000		
	Unit: msec		

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P1 - 36	TSL	Accel /Decel S-curve	Communication Addr.: 0124H

Default: 0 Applicable Control Mode: P/S

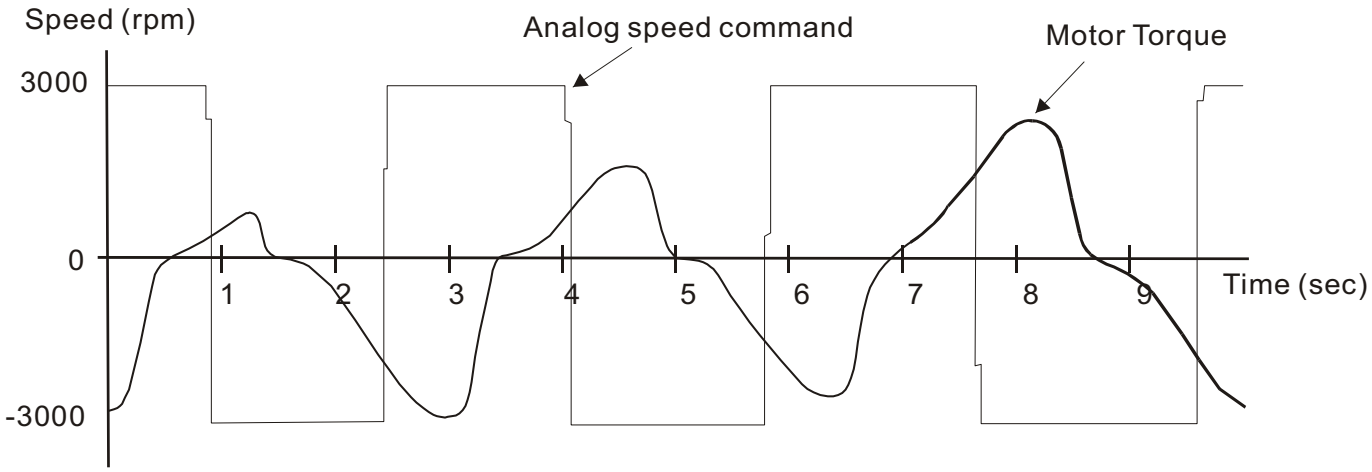
Range: 0~10000 (0: disabled)

Unit: msec

📖 Note: If the setting value of parameter P1-36 is set to 0, it indicates Accel / Decel S-curve function is disabled and the command is just By-Pass.

Analog Input Filter

ASDA-A series AC drive also provide analog input filter for the smoothing in response to a sudden analog input signal.



The analog input filter is for the smoothing of analog input signal and its function is the same as the S-curve filter. The speed and acceleration curve of analog input filter are both continuous. The above figure shows the curve of analog input filter and you can see the ramp of speed command is different during acceleration and deceleration. Also, you can see the difference of input command tracking. Users can adjust time setting by using parameter P1-34, P1-35, P1-36 to improve the curve according to actual condition.

Input Command Low-pass Filter

Command (Input) Low-pass Filter is used to eliminate the high frequency response and interference or noise and it is with smoothing function.

Relevant parameters:

P1 - 06	SFLT	Accel / Decel Smooth Constant of Analog Speed Command (Low-pass filter)	Communication Addr.: 0106H

Default: 0 Applicable Control Mode: S

Range: 0~1000 (0: Disabled)

Unit: msec

📖 Note: If the setting value of parameter P1-06 is set to 0, it indicates the function of this parameter is disabled and the command is just By-Pass.

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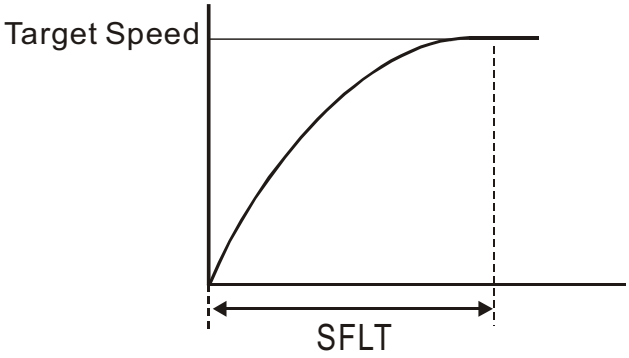

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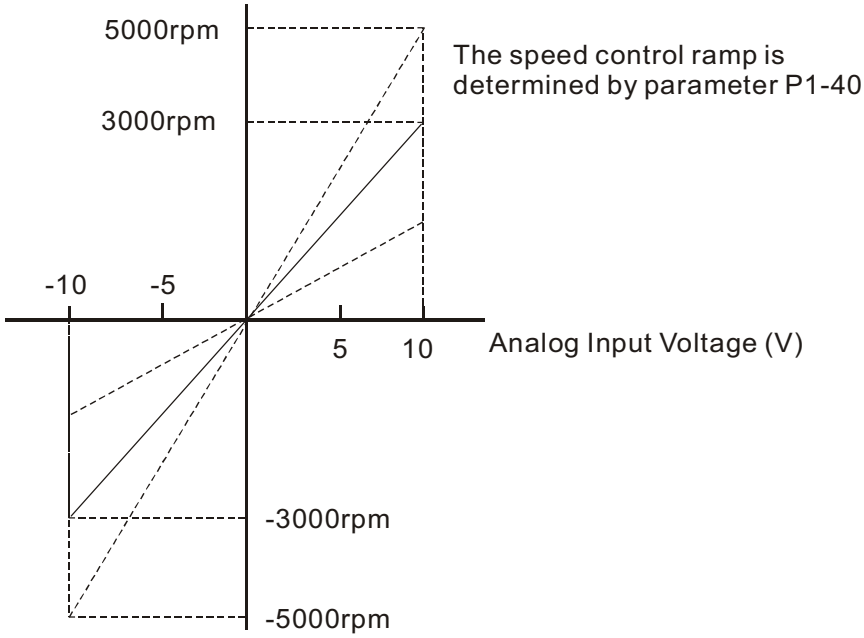
6-3-4 Analog Input Proportional Gain (Scalar)

The analog voltage between **V_REF and GND** controls the motor speed command. Using with parameter P1-40 can adjust the speed control ramp and its range.



P1 - 40▲	VCM	Max. Analog Speed Command	Communication Addr.: 0128H

Default: rated Applicable Control Mode: P/S/T

Range: 0~10000

Unit: rpm

📖 Note: For example, when P1-40 is set to 2000, the max. rotation speed of analog speed command (10V) is 2000rpm.

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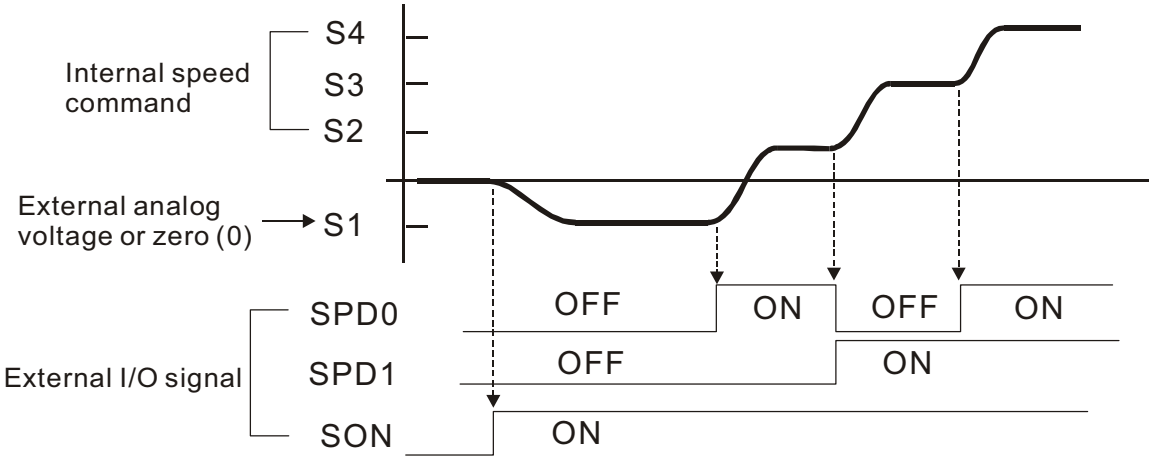
6-3-5 Timing Chart of Speed Control Mode



📖 Note:

1. OFF indicates normally open and ON indicates normally closed.
2. When speed control mode is Sz, the speed command S1=0; when speed control mode is S, the speed command S1 is external analog voltage input.
3. After Servo ON, users can select command according to the state of SPD0~1.

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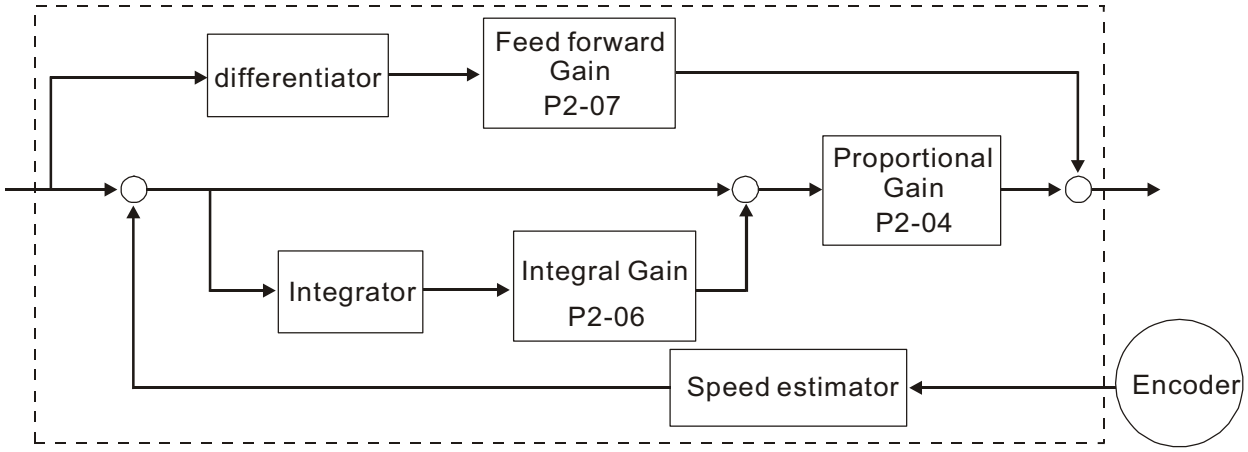
6-3-6 Speed Loop Gain Adjustment

The function and structure of **speed control block diagram** is shown as the figure below:

Speed Control Block Diagram



There are three turning modes of gain adjustment: Manual, Auto and Easy modes.

- **Manual Mode:** User-defined loop gain adjustment. When using this mode, all auto and auxiliary function will be disabled.
- **Auto Mode:** Continuous adjustment of loop gains according to measured inertia, with ten levels of system bandwidth. The parameter set by user is default value.
- **Easy Mode:** Robust for wide range of external load inertia change, with ten levels of system stiffness. Using easy mode can immediately suppress the interference of external load and mechanical resonance and also stand for the load inertia change.

The mode of gain adjustment can be selected by parameter P2-32:

P2 - 32▲	AUT2	Gain Adjustment Method	Communication Addr.: 0220H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~5

Setting:

0: Manual mode

1: Easy mode

2: PI auto-tuning mode (Continuous adjustment)

3: PI auto-tuning mode (Fix the ratio of Load Inertia to servo motor inertia and response level can be adjusted)

4: PDFF auto-tuning mode (Continuous adjust)

5: PDFF auto-tuning mode (Fix the ratio of Load Inertia to servo motor inertia and response level can be adjusted)

PI : Proportional - Integral control

PDFF : Pseudo-Derivative Feedback and Feedforward

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Manual Mode

When P2-32 is set to 0, users can define the proportional gain of speed loop (P2-04), integral gain (P2-06) and feed forward gain (P2-07). Please refer to the following description:

- Proportional gain: Adjust this gain can increase the response bandwidth of position loop.
- Integral gain: Adjust this gain can enhance the low-frequency stiffness of speed loop and eliminate the steady error. Also, reduce the value of phase margin. Over high integral gain will result in the unstable servo system.
- Feed forward gain: Adjust this gain, the phase delay time during operation is nearly zero when the setting is close to 100%.

Relevant parameters:

P2 - 04	KVP	Proportional Speed Loop Gain	Communication Addr.: 0204H
Default: 500 Range: 2~100 Unit: msec			Applicable Control Mode: P/S

P2 - 06	KVI	Speed Integral Compensation	Communication Addr.: 0206H
Default: 100 Range: 0~4095			Applicable Control Mode: P/S

P2 - 07	KVF	Speed Feed Forward Gain	Communication Addr.: 0207H
Default: 0 Range: 0~20000 Unit: 0.0001			Applicable Control Mode: S

In theory, stepping response can be used to explain proportional gain (KVP), integral gain (KVI) and feed forward gain (KVF). Now we use frequency area and time area respectively to explain the logic.

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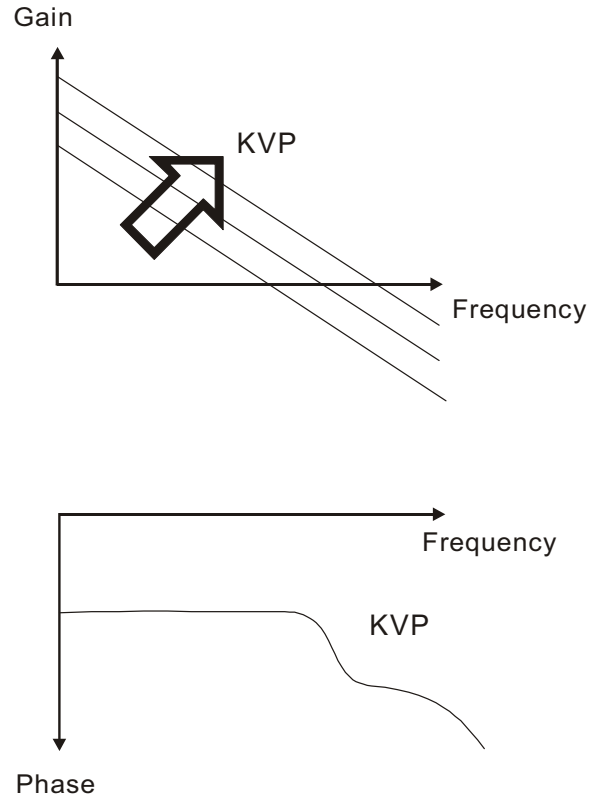
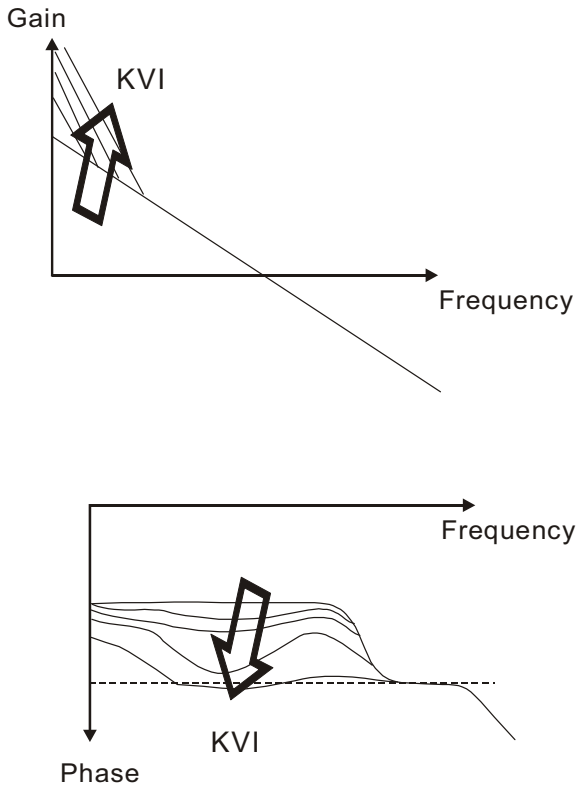
Frequency Domain

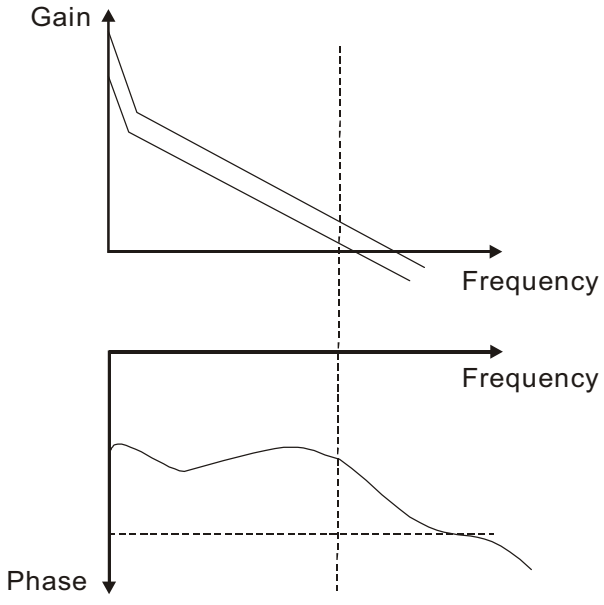
STEP 1: Set the value of KVI=0, the value of KVF=0 and adjust the value of KVP.



STEP 2：Fix the value of KVP and adjust the value of KVI.



STEP 3：Select the value of KVI, if the value of phase margin is too small, re-adjust the value of KVP again to obtain the value, 45deg of phase margin.



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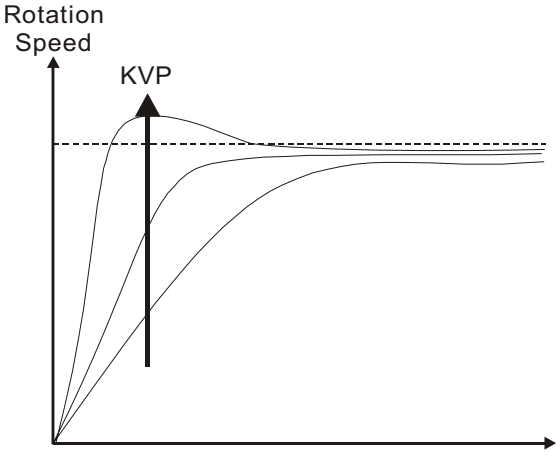
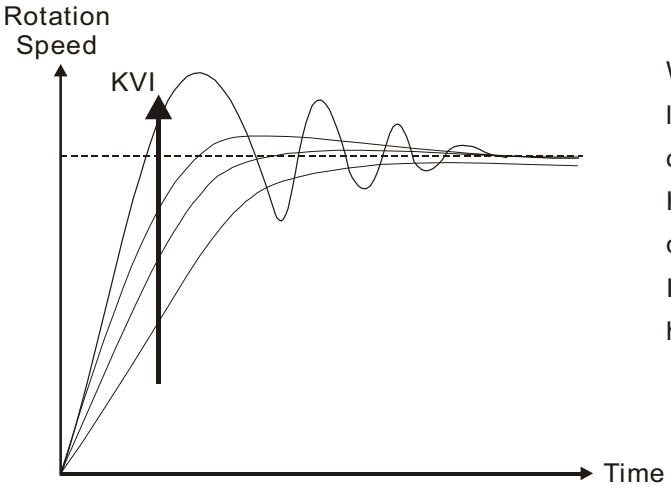
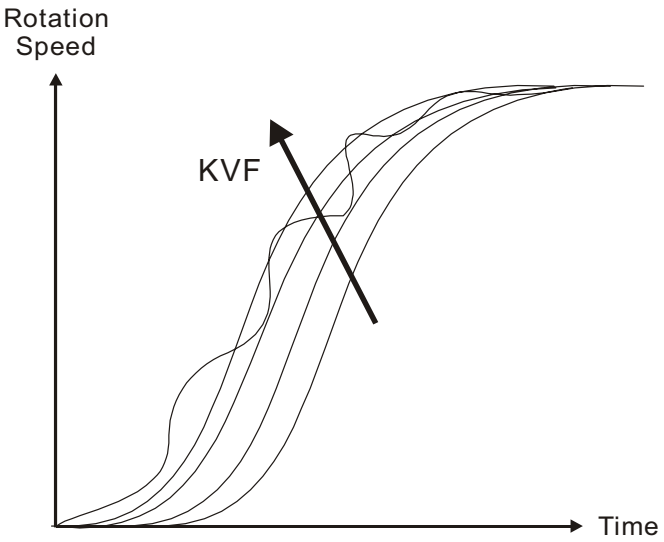
Time Domain



When the value of KVP is greate , the value of the bandwidthis also greater and the raising time is shorter. However, when the value of phase margin is over low, it is not more helpful to steady error.
But it is more helpful to dynamic tracking error.



When the value of KVI is greater, the value of low-frequency gain is also greater and the value of steady error is nearly zero (0).
However, the value of phase margin will reduce quite substantially.
It is more helpful to steady error. But it is not more helpful to dynamic tracking error.



When the value of KVF is nearly to zero (0), the phase delay time is also nearly to zero (0) and the value of dynamic tracking error will become very small. However, when the value of KVF is too great, it may cause vibration.

In general, when using frequency domain method need equipment, such as spectrum analyzer to analyze and users also should have this kind of analysis technology. However, when using time domain method, users only need to prepare an oscilloscope. Hence, general users usually use time domain method with the analog DI/DO terminal provided by the servo drive to adjust what is called as PI (Proportional and Integral) type controller. As for the performance of torque shaft load, input command tracking and torque shaft load have the same response when using frequency domain method and time domain method. For users, you can reduce the bandwidth of input command tracking by using input command low-pass filter.

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Easy Mode

When P2-32 is set to 1, the easy mode function is activated. In order to enhance the performance of servo system, ASDA-A series servo drive provide **"Robust Control Technology"** when user select the easy mode of tuning technology. The following introduces the basic structure.

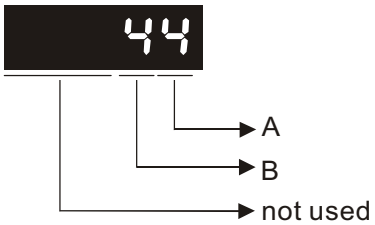
The servo motor with inertia change will operate close to reference ideal mode due to the feedback inside of current loop and the torque load will give the compensation immediately inside of the current loop. When the permissible inertia change is greater, it will be much easier to influence the performance of servo system. For the strong functionality and robust control of Delta servo system, the easy mode provides servo system can be robust for the wide range of external load inertia change, with ten levels of system stiffness.

Users only need to set the "A" value of parameter P2-31 to select ten levels of system stiffness. The value is greater, the stiffness is increased and the frequency response is faster.

P2 - 31	AUT1	Auto and Easy Mode Selection	Communication Addr.: 021FH

Default: 44 Applicable Control Mode: P/S/T

Range: 0~FF



A: Stiffness setting of easy mode

B: Response setting of auto-tuning mode

Note: This parameter is activated by P2-32.

Stiffness Setting in Easy Mode (P2-31 value "A") and the setting of P2-00, P2-25

	Level (P2-31 Value A)	Load Range (J_load /J_motor)	Max. Load Corresponding Responsiveness	KPP (P2-00)	NLP (P2-25)	Remark
Low Responsive-ness Level	1	50~100	5Hz	5	50	The setting of P2-00 and P2-25 must be inputted manually
	2	30~50	8Hz	8	31	
	3	20~30	11Hz	11	33	
	4	16~20	15Hz	15	16	
Medium Responsiveness Level	5	12~16	20Hz	20	12	The setting of P2-00 and P2-25 must be inputted manually
	6	8~12	27Hz	27	9	
	7	5~8	40Hz	40	6	
	8	2~5	60Hz	60	4	
	9	0~2	115Hz	115	2	

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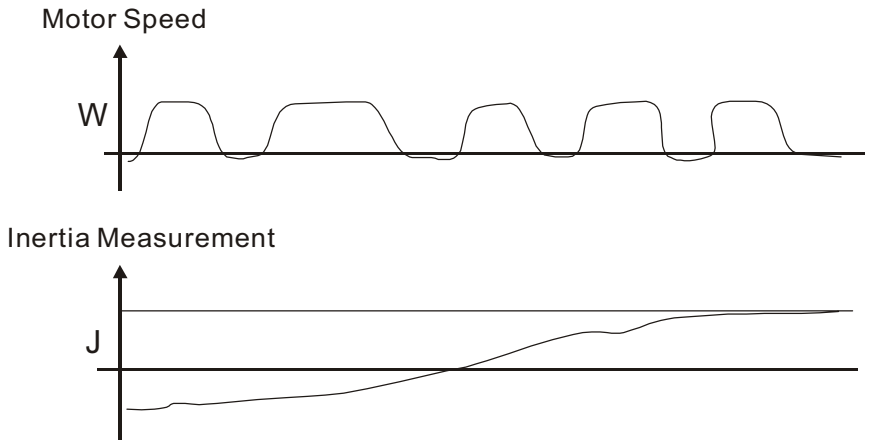
	Level (P2-31 Value A)	Load Range (J_load /J_motor)	Max. Load Corresponding Responsiveness	KPP (P2-00)	NLP (P2-25)	Remark
High Responsiveness Level	A	0~2	127Hz	127	1	The setting of P2-00 and P2-25 must be inputted manually
	B	2~8	103Hz	103	2	
	C	8~15	76Hz	76	3	
	D	15~25	62Hz	62	4	
	E	25~50	45Hz	45	5	
	F	50~100	36Hz	36	6	

Auto Mode (Auto-tuning)

The auto mode provides continuous adjustment of loop gains according to measured inertia and is not suitable for wide range of load inertia change. The period of adjustment time is different depending on the acceleration and deceleration of servo motor.



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6-3-7 Resonance Suppression

The resonance of mechanical system may occur due to excessive system stiffness or frequency response. However, this kind of resonance condition can be improved, suppressed, even can be eliminated by using low-pass filter (parameter P2-25) and notch filter (parameter P2-23, P2-24) without changing control parameter.

P2 - 23	NCF	Notch Filter Frequency of Resonance Suppression	Communication Addr.: 0217H

Default: 1000 Applicable Control Mode: P/S/T

Range: 50~1000

Unit: Hz

P2 - 24	DPH	Notch Filter Attenuation Ratio of Resonance Suppression	Communication Addr.: 0218H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~32

Unit: dB

0: Disabled

P2 - 25	NLP	Low-pass Filter Time Constant of Resonance Suppression	Communication Addr.: 0219H

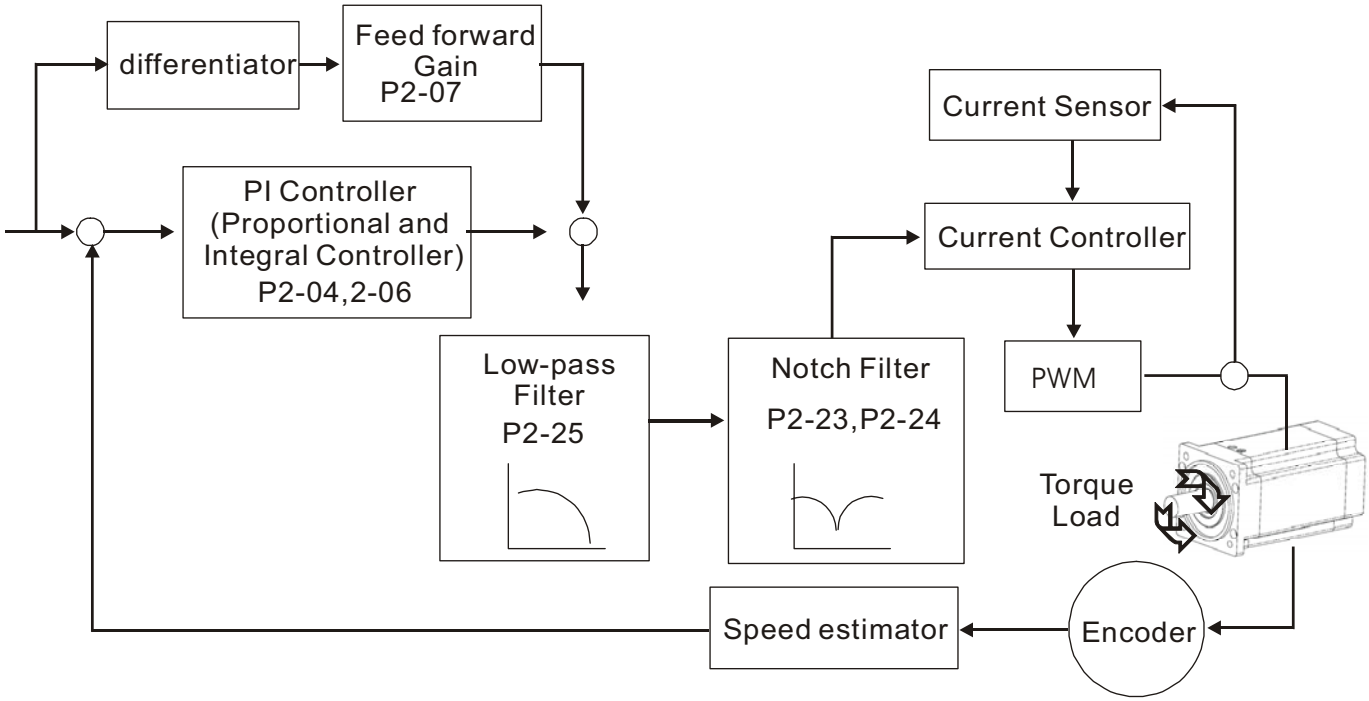
Default: 2 (1KW and below models) or Applicable Control Mode: P/S/T

5 (1KW and below above models)

Range: 0~1000

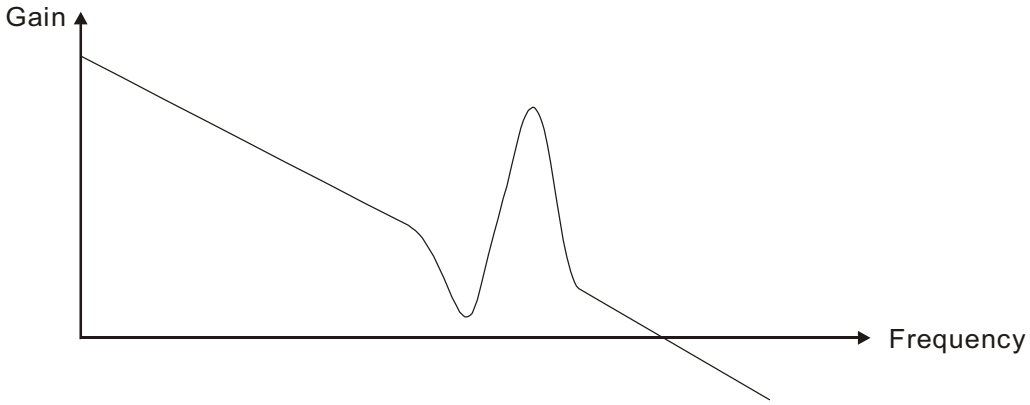
Unit: msec

Speed Control Block Diagram

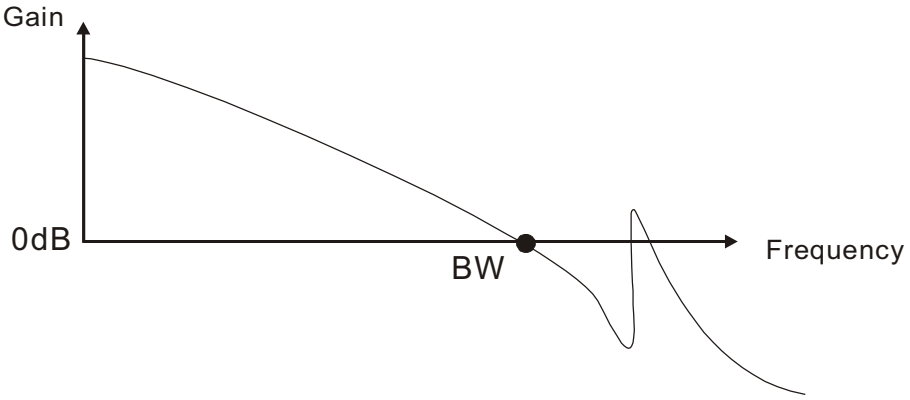


Low-pass filter

Please use parameter P2-25. The figure below shows the resonant open loop gain.



When the low-pass filter (parameter P2-25) is adjusted from 0 to high value, the value of BW will become smaller (see the figure below). The resonant condition is improved and the frequency response and phase margin also decrease.



Notch Filter

If the resonant frequency can be recognized, then users can directly use notch filter (parameter P2-23, P2-24) to eliminate the resonance. However, the range of frequency setting is only from 50 to 1000Hz and its resonant attenuation is only 0~32 dB. If the resonant frequency is out side of this range, we recommend users to use low-pass filter to improve resonant condition.

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6-4 Torque Control Mode

The torque control mode (T or Tz) is usually used on the applications of torque control, such as printing machine, spinning machine, twister, etc. Delta servo drive supports two kinds of command sources in torque control mode. One is external analog signal and the other is internal parameter. The external analog signal is from external voltage input and it can control the torque of servo motor. The internal parameter is from P1-12 to P1-14 used to be the torque command in torque control mode.

6-4-1 Command Source of Torque Control Mode

Torque command Source:

1. External analog signal: External analog voltage input, -10V to +10V
2. Internal parameter: P1-09 to P1-11

The command source selection is determined by the DI signal of CN1 connector. Please refer to the table below:

Torque Command	DI signal of CN1		Command Source			Content	Range
	TCM1	TCM0					
T1	0	0	Mode	T	External analog signal	Voltage between T-REF-GND	+/-10 V
				Tz	None	Torque command is 0	0
T2	0	1	Internal parameter			P1-12	0 ~ 300 %
T3	1	0				P1-13	0 ~ 300 %
T4	1	1				P1-14	0 ~ 300 %

- **State of TCM0~1**:
  0: indicates OFF (normally open is contact “a”)
  1: indicates ON (normally closed is contact “b”)

- When **TCM0=TCM1=0 (OFF)**, if the control mode of operation is Tz, then the command is 0. Therefore, if users do not use analog voltage as torque command, users can choose Tz mode to operation torque control to avoid the zero point drift problem of analog voltage. If the control mode of operation is T, then the command is the analog voltage between **T-REF and GND.** The setting range of the input voltage is from -10V to +10V and the corresponding torque is adjustable (see parameter P1-41).

- When one of **TCM0 and TCM1 is not 0 (OFF)**, the torque command is internal parameter. The command is valid (enabled) after **TCM0~1 is changed and it doesn’t need that CTRG should be triggered.**

The torque command that is described in this section not only can be taken as torque command in torque control mode (T or Tz mode) but also can be the torque limit input command in speed control mode (S or Sz mode).

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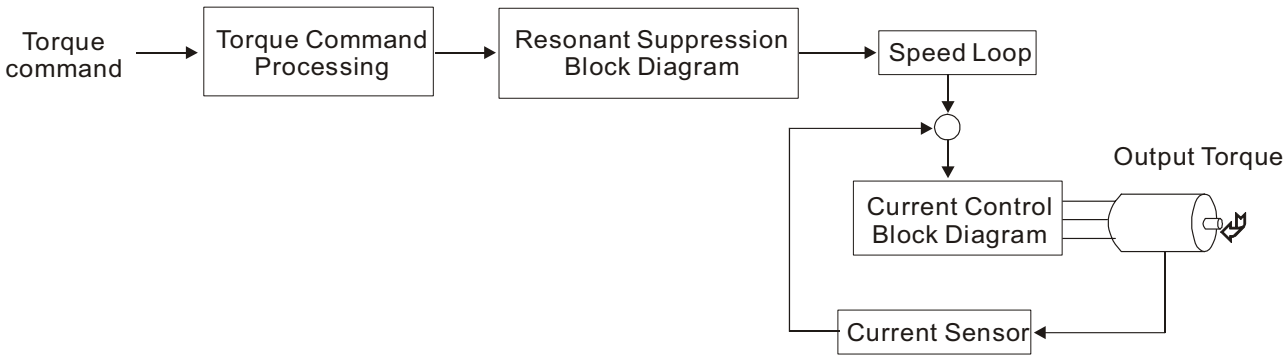
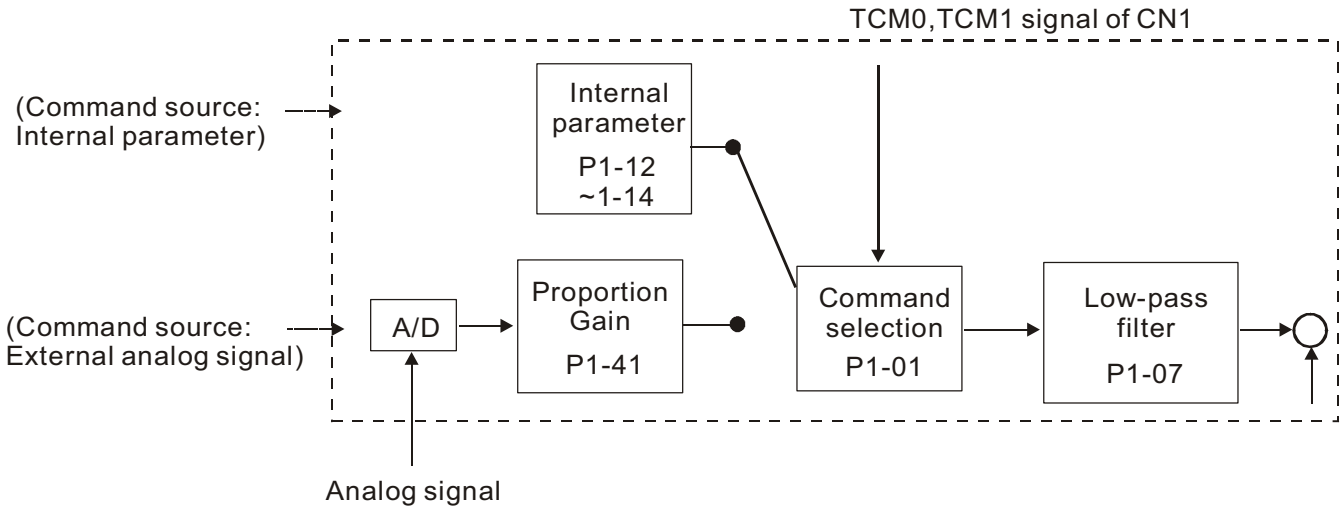
6-4-2 Structure of Torque Control Mode

Basic Structure:



In the above figure, the **toque command processing** is used to select the command source of torque control according to chapter 6-4-1, including max. output of analog torque limit (parameter P1-41) and smoothing strategy of torque control mode. The **current control block diagram** is used to manage the gain parameters of the servo drive and calculate the current input provided to motor instantaneously. ASDA-A series servo drive only provides input command parameter.

The function and structure of **torque command processing** is shown as the figure below:



The command source is selected according to the state of **TCM0, TCM1** and parameter P1-01 (T or Tz). Whenever the command signal need to be more smoothly, we recommend users to use proportional gain (scalar) and low-pass filter to adjust torque.

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6-4-3 Smoothing Strategy of Torque Control Mode

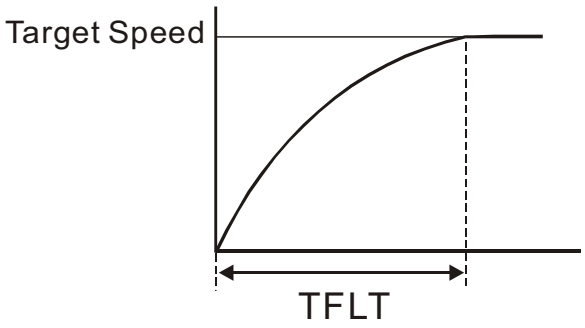
P1 - 07	TFLT	Smooth Constant of Analog Torque Command (Low-pass smooth filter)	Communication Addr.: 0107H

Default: 0 Applicable Control Mode: T

Range: 0~100 (0: Disabled)

Unit: msec

📖 Note: If the setting value of parameter P1-07 is set to 0, it indicates the function of this parameter is disabled and the command is just By-Pass.



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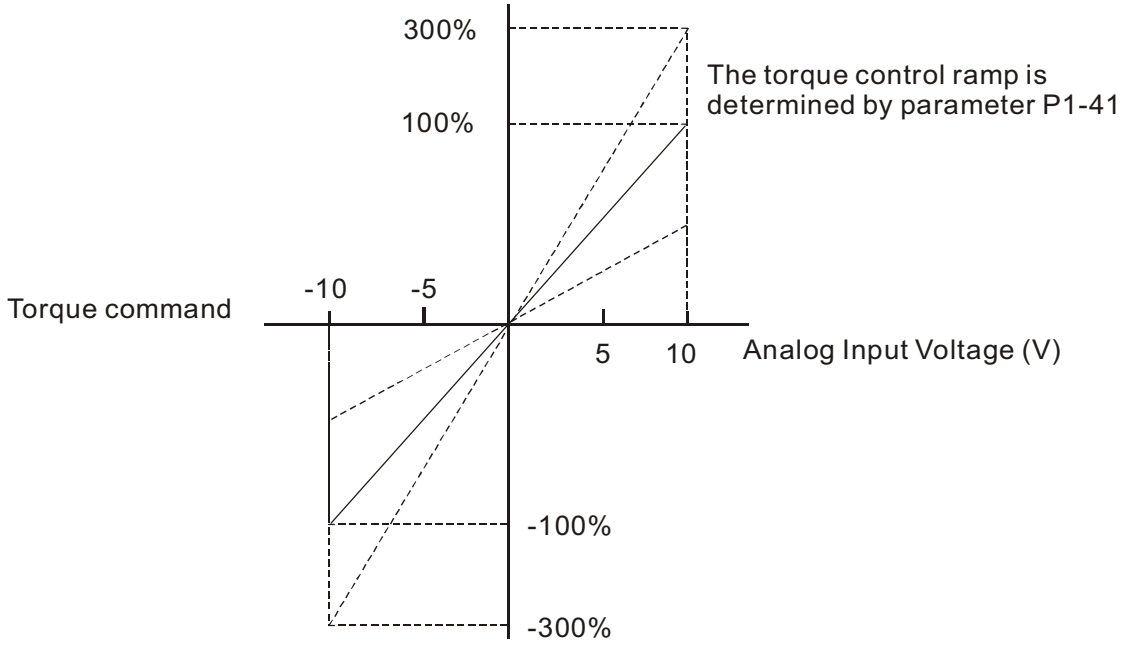
6-4-4 Analog Input Proportional Gain (Scalar)

The analog voltage between **T_REF and GND** controls the motor torque command. Using with parameter P1-41 can adjust the torque control ramp and its range.



P1 - 41▲	TCM	Max. Analog Torque Command	Communication Addr.: 0129H

Default: 100 Applicable Control Mode: P/S/T

Range: 0~1000

Unit: %

📖 Note: For example, if P1-41 is set to 100 and the input voltage is 10V, it indicates that the torque command is 100% rated torque.

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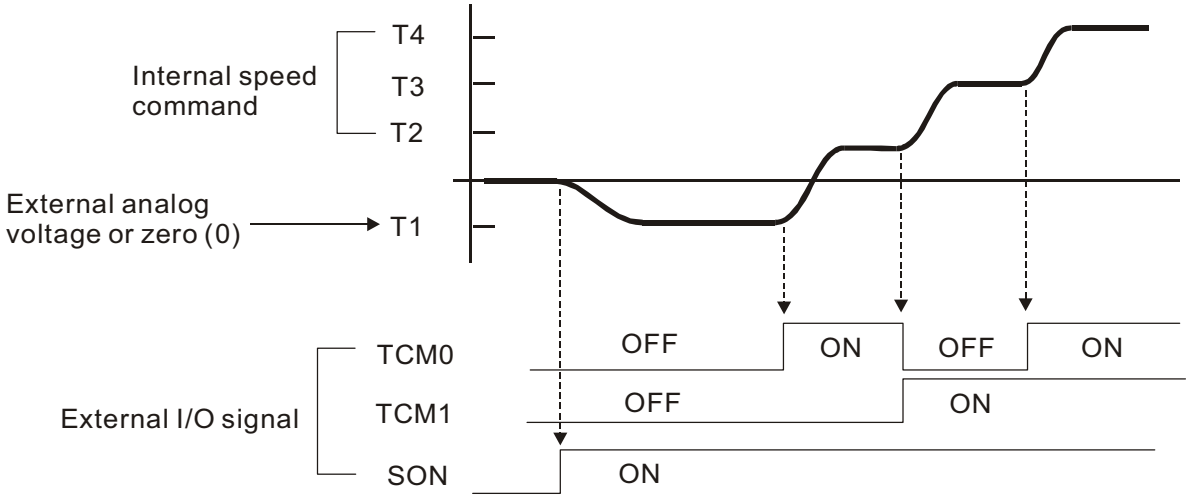
6-4-5 Timing Chart of Speed Control Mode



Note:

1. OFF indicates normally open and ON indicates normally closed.
2. When speed control mode is Tz, the torque command T1=0; when speed control mode is T, the torque command T1 is external analog voltage input.
3. After Servo ON, users can select command according to the state of TCM0~1.

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6-5 Control Modes Selection

Except signal control mode operation, ASDA-A series AC drive also provide Pt-S, Pr-S, S-T, Pt-T, Pr-T these five multiple modes for user to select.

1） Speed / Position mode selection: Pt-S, Pr-S

2） Speed / Torque mode selection: S-T

3） Torque / Position mode selection: Pt-T, Pr-T

Mode	Name	Code	Description
Dual Mode	**Pt-S**	**06**	Either **Pt** or **S** control mode can be selected via the Digital Inputs (DI)
	Pt-T	**07**	Either **Pt** or **T** control mode can be selected via the Digital Inputs (DI)
	Pr-S	**08**	Either **Pr** or **S** control mode can be selected via the Digital Inputs (DI)
	Pr-T	**09**	Either **Pr** or **T** control mode can be selected via the Digital Inputs (DI)
	S-T	**10**	Either **S** or **T** control mode can be selected via the Digital Inputs (DI)

Sz and Tz mode selection is not provided. In order to avoid using too much DI inputs, we recommend that user can use external analog signal as input command in speed and torque mode to reduce the use of DI inputs (**SPD0~1 or TCM0~1**). In position mode, we recommend that users can use Pt mode to input pulse to reduce the use of DI inputs (**POS0~2**).

Please refer to **table 3.H** and **table 3.I** in **section 3-3-2** to see the default DI/DO signal in different modes.

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6-5-1 Speed / Position Control Mode Selection

Pt-S Mode / Pr-S Mode:

The command source of Pt-S mode is from external input pulse. The command source of Pr-S mode is from internal parameters (P1-15 to P1-30). The speed command can be the external analog voltage or internal parameters (P1-09 to P1-11). The speed and position mode switching is controlled by the **S-P** signal. The selection will be more complicated when the position of Pr-S mode and speed command are both selected through DI signal.

The timing chart of speed / position control mode selection is shown as the figure below:

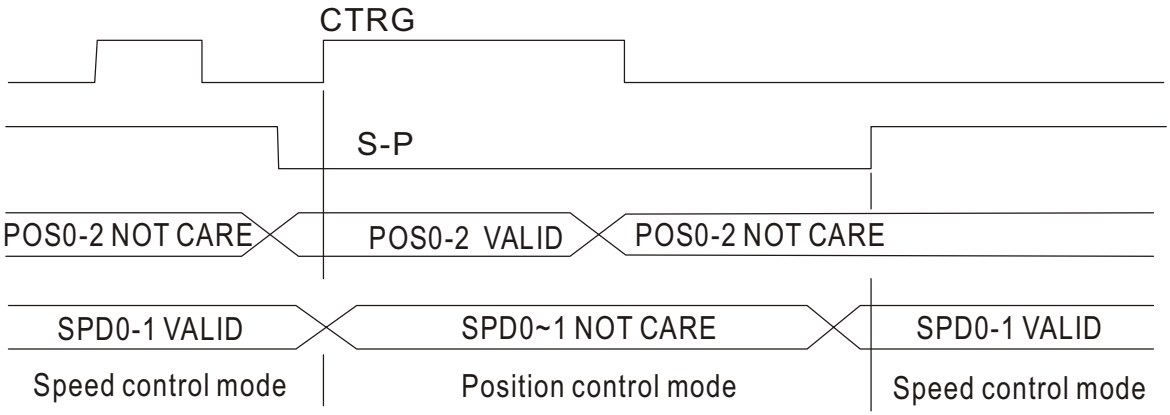

Figure 1. : Speed / Position Control Mode Selection

In speed mode (when **S-P** is ON), speed command is selected by **SPD0~1** and **CTRG** is disabled at this time. When switching to the position mode (when **S-P** is OFF), the position command is not determined (it needs to wait that **CTRG** is on the rising edge), so the motor stop running. Once **CTRG** is on the rising edge, position command will be selected according to **POS0~2** and the motor will immediately move to the determined position. After **S-P** is ON, it will immediately return to speed mode.

For the relationship between DI signal and selected command in each mode, please refer to the introduction of single mode.

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6-5-2 Speed / Torque Control Mode Selection

S-T Mode:

The speed command can be the external analog voltage or internal parameters (P1-09 to P1-11) and **SPD0~1** is used to select speed command. The same as speed command, the torque command can be the external analog voltage or internal parameters (P1-12 to P1-14) and **TCM0~1** is used to select torque command The speed and torque mode switching is controlled by the **S-T** signal.

The timing chart of speed / torque control mode selection is shown as the figure below:

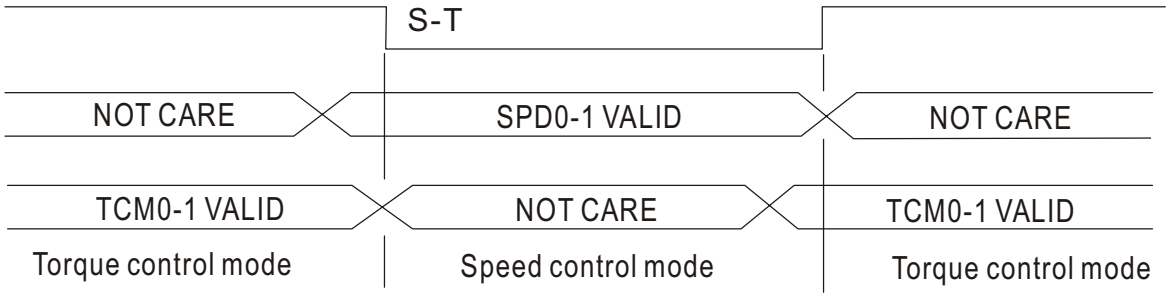

Figure 2. : Speed / Torque Control Mode Selection

In torque mode (when **S-T** is ON), torque command is selected by **TCM0~1**. When switching to the position mode (when **S-T** is OFF), the torque command is selected by **SPD0~1**, and then the motor will immediately rotate following the command. After **S-T** is ON, it will immediately return to torque mode. For the relationship between DI signal and selected command in each mode, please refer to the introduction of single mode.

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6-5-3 Torque / Position Control Mode Selection

Pt-T Mode / Pr-T Mode:

The command source of Pt-T mode is from external input pulse. The command source of Pr-T mode is from internal parameters (P1-15 to P1-30). The torque command can be the external input pulse or internal parameters (P1-12 to P1-14). The torque and position mode switching is controlled by **T-P** signal. The selection will be more complicated when the position of Pr-T mode and torque command are both selected through DI signal.

The timing chart of speed / position control mode selection is shown as the figure below:

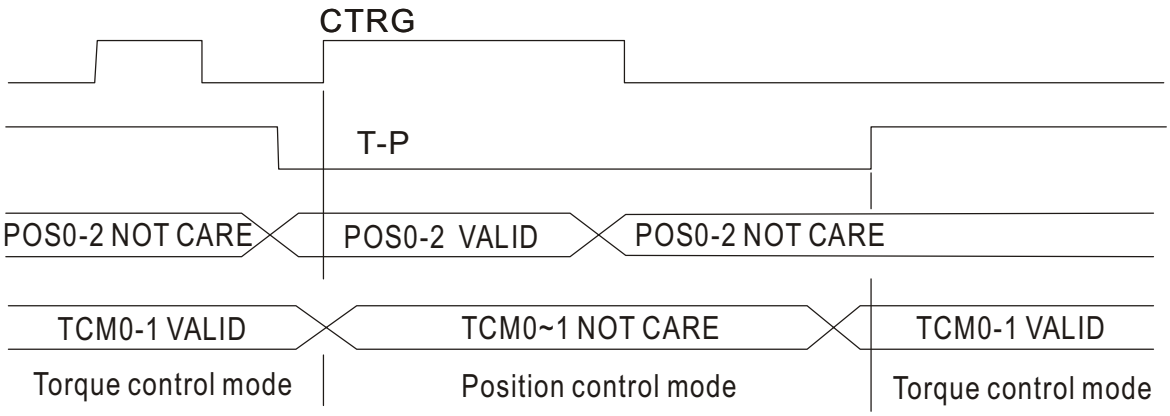

Figure 3. : Torque / Position Control Mode Selection

In torque mode (when **T-P** is ON), torque command is selected by **TCM0~1** and **CTRG** is disabled at this time. When switching to the position mode (when **T-P** is OFF), the position command is not determined (it needs to wait that **CTRG** is on the rising edge), so the motor stop running. Once **CTRG** is on the rising edge, position command will be selected according to **POS0~2** and the motor will immediately move to the determined position. After **T-P** is ON, it will immediately return to torque mode.

For the relationship between DI signal and selected command in each mode, please refer to the introduction of single mode.

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6-6 Others

6-6-1 Speed Limit

The max. servo motor speed can be limited by using parameter P1-55 no matter in position, speed or torque control mode.

The command source of speed limit command is the same as speed command. It can be the external analog voltage but also can be internal parameters (P1-09 to P1-11). For more information of speed command source, please refer to chapter 6-3-1.

The speed limit only can be used in torque mode (T mode) to limit the servo motor speed. When the torque command is the external analog voltage, there should be surplus DI signal that can be treated as **SPD0~1** used to select speed limit command (internal parameter). If there is not enough DI signal, the external voltage input can be used as speed limit command. When the setting value of X in P1-02 is equal to 1, the speed limit function is activated.

The timing chart of speed limit is shown as the figure below:

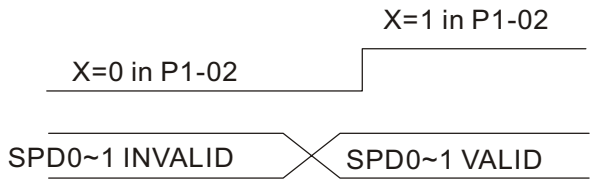

Figure 4. : Command Source Selection of Speed Limit

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6-6-2 Torque Limit

The command source of torque limit command is the same as torque command. It can be the external analog voltage but also can be internal parameters (P1-12 to P1-14). For more information of torque command source, please refer to chapter 6-4-1.

The speed limit only can be used in position mode (Pt and Pr mode) and speed mode (S mode) to limit the output torque of servo motor. When the position and speed command is the external analog voltage, there should be surplus DI signal that can be treated as **TCM0~1** used to select torque limit command (internal parameter). If there is not enough DI signal, the external voltage input can be used as torque limit command. When the setting value of Y in P1-02 is equal to 1, the torque limit function is activated.

The timing chart of torque limit is shown as the figure below:

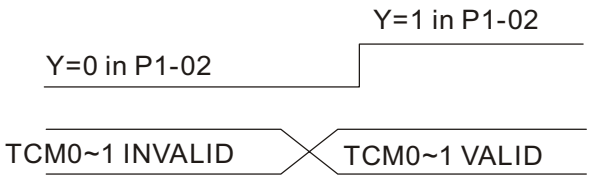

Figure 5. : Command Source Selection of Torque Limit

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6-6-3 Regenerative Resistor

Built-in Regenerative Resistor

When the output torque of servo motor in reverse direction of motor rotation speed, it indicates that there is a regenerative power is returned from the load to the servo drive. This power will be transmitted into the capacitance of DC Bus and result in rising voltage. When the voltage has risen to some high voltage, using regenerative resistor can dischange. ASDA-A series servo drive provides built-in regenerative resistor but user also can connect to external regenerative resistor.

The following table shows the specifications of the servo drive's built-in regenerative resistor and the amount of regenerative power (average value) that it can process.

Servo Drive (kW)	Built-in Regenerative Resistor Specifications		Regenerative Power processed by built-in regenerative resistor (Watt) *1	Min. Allowable Resistance (Ohm)
	Resistance (Ohm) (parameter P1-52)	Capacity (Watt) (parameter P1-53)		
0.1	40	60	30	40
0.2	40	60	30	40
0.4	40	60	30	20
0.75	40	60	30	20
1.0	40	60	30	20
1.5	40	60	30	20
2.0	20	120	60	10
3.0	20	120	60	10

*1: Regenerative power calculation: The amount of regenerative power (average value) that can be processed is rated at 50% of the capacity of the servo drive's built-in regenerative resistor. The regenerative power calculation method of external regenerative resistor is the same.

When the regenerative power exceeds the processing capacity of the servo drive, install an external regenerative resistor. Please pay close attention on the following notes when using a regenerative resistor.

1. Make sure that the settings of resistance (parameter P1-52) and capacity (parameter P1-53) is set correctly.
2. When user wants to install an external regenerative resistor, ensure that its resistance value is the same as the resistance of built-in regenerative resistor. If combining multiple small-capacity regenerative resistors in parallel to increase the regenerative resistor capacity, make sure that the resistance value of the regenerative resistor should comply with the specifications listed in the above table.
3. In general, when the amount of regenerative power (average value) that can be processed are used at or below the rated load ratio, the resistance temperature will increase to 120°C or higher (on condition that when the regeneration continuously occurred). For the safety reason, forced air cooling is good way that can be used to reduce the temperature of the regenerative resistors. We also recommend you to use the regenerative resistors with thermal switches. As for the load characteristics of the regenerative resistors, please check with the manufacturer.

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External Regenerative Resistor

When using external regenerative resistor, connect it to P and C, and make sure the circuit between P and D is open. We recommend user should use the external regenerative resistor that the resistance value following the above table. We ignore the discharge power of IGBT in order to let user easily calculate the power of regenerative resistor. In the following sections, we will describe Regenerative Power Calculation Method and Simple Calculation Method for calculating the regenerative power capacity of external regenerative resistors.

■ Regenerative Power Calculation Method

(a) When there is no external load torque, if the servo motor repeats operation, the returned regenerative power generated when braking will transmitted into the capacitance of DC bus. After the capacitance voltage exceeds some high value, regenerative resistor can discharge the remained regenerative power. Use the table and procedure described below to calculate the regenerative power.

Servo Drive (kW)	Rotor Inertia J (kg. m^2)	Regenerative power from empty load 3000rpm to stop Eo (joule)	Max. regenerative power of capacitance Ec(joule)
0.1	0.03E-4	0.15	3
0.2	0.18E-4	0.89	4
0.4	0.34E-4	1.68	8
0.75	1.08E-4	5.34	14
1.0	2.60E-4	12.86	18
1.5	3.60E-4	17.80	18
2.0	4.70E-4	23.24	21
3.0	11.6E-4	57.36	28

Eo= J *wr^2/182 (joule) , Wr : rpm

If the load inertia is N × motor inertia, the regenerative power will be (N+1) × E0 when servo motor brakes from 3000rpm to 0. Then, the regenerative resistor can discharge: (N+1) × E0－Ec (joule). If the time of repeat operation cycle is T sec, then the regenerative power = ((N+1) × E0－Ec) / T. The calculating procedure is as follows:

Step	Procedure	Equation and Setting Method
1	Set the capacity of regenerative resistor to the maximum	Change the value of P1-53 to maximum
2	Set the operation cycle T	Input by user
3	Set rotation speed wr	Input by user or via parameter P0-02 Drive State Display
4	Set load/motor inertia ratio N	User Input or via P0-02 Drive State Display
5	Calculate the max. regenerative power Eo	Eo= J * wr2/182
6	Set the regenerative power Ec that can be absorbed	Refer to the table above
7	Calculate the required regenerative power capacity	2 × (N+1) × Eo－Ec） / T

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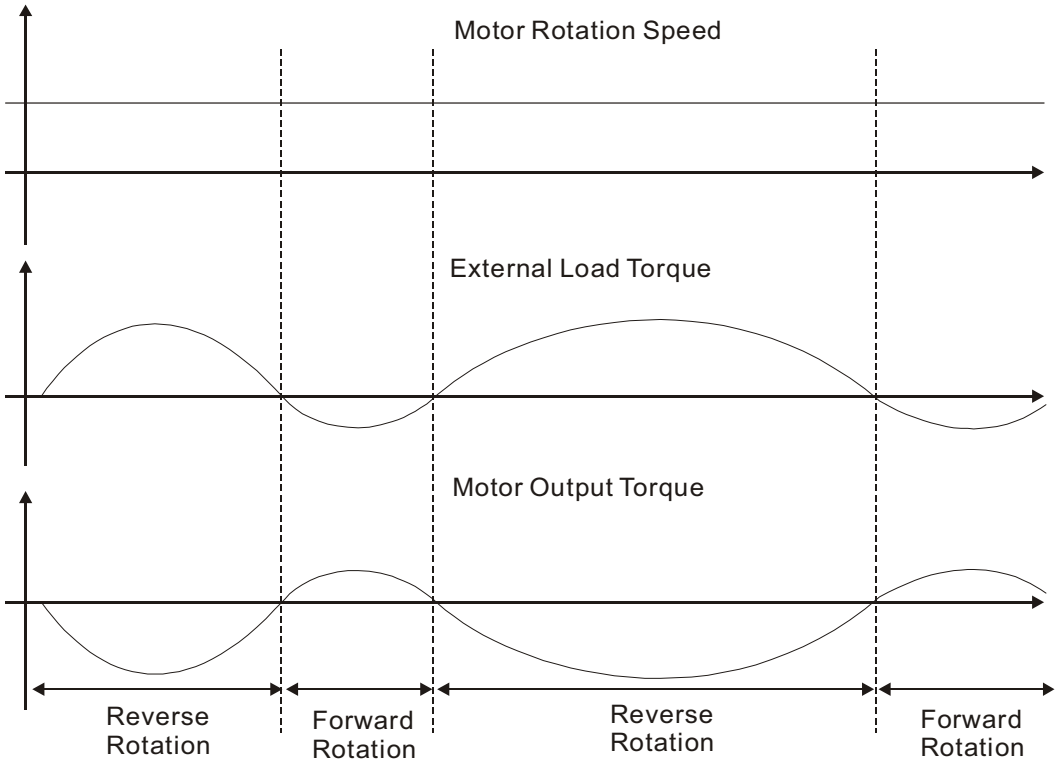
For example:

If we use 400W servo drive, the time of repeat operation cycle is T = 0.4 sec, max. rotation speed is 3000rpm, the load inertia = 7 × motor inertia, then the necessary the power of regenerative resistor = 2 × ((7+1) × 1.68 − 8) / 0.4=27.2W. If the regenerative power is very small, we recommend user to use the built-in 60W regenerative resistor. Generally speaking, the built-in regenerative resistor provided by ASDA-A series can meet the requirement of general application when the external load inertia is not excessive.

The following figure shows the actual operation of regenerative resistor. You can see when the capacity of regenerative resistor is too small, the accumulated power will be larger and the temperature will also increase. The fault, ALE05 may occur if the temperature is over high.

(b) When there is an external load torque, servo motor is in reverse rotation when external load greater than motor torque. Servo motor is usually in forward rotation and the motor torque output direction is the same as the rotation direction. However, there is still some special condition. If the motor output torque is in the reverse direction of rotation, the servo motor is also in the reverse direction of rotation. The external power is input into the servo drive through servo motor. The figure below is an example. You can see the motor is in forward rotation at constant speed when a sudden external load torque change and great power is transmitted to regenerative resistor rapidly.



External load torque in reverse direction: TL* Wr TL : External load torque

For the safety, we strongly recommend users should select the proper resistance value according to the load.

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For example:

When external load torque is a +70% rated torque and rotation speed reachs 3000 rpm, if using 400W servo drive (rated torque: 1.27Nt-m), then users need to connect a external regenerative resistor which power is $2 \times (0.7 \times 1.27) \times (3000 \times 2 \times \pi / 60)$ = 560W, 40Ω.

■ Simple Calculation Method

User can select the adequate regenerative resistors according to the allowable frequency required by actual operation and the allowable frequency when the servo motor run without load. The allowable frequency when the servo motor run without load is the maximum frequency that can be operated during continuous operation when servo motor accelerate from 0rpm to rated speed and decelerate from rated speed down to 0rpm. The allowable frequencies when the servo motor run without load are summarized in the following table.

Servo Motor Models	Allowable frequencies when the servo motor run without load (times/min)							
	100W	200W	400W	750W	1.0kW	1.5kW	2.0kW	3.0kW
	01	02	04	07	10	15	20	30
ASMT□□L Series	12133	2022	1071	337	140	100	155	63
ASMT□□M Series	-	-	-	-	136	93	104	38

When the servo motor run with load, the allowable frequencies will change according to the changes of the load inertia and rotation speed. Use the following equation to calculate the allowable frequency.

$$\text{Allowable frequency} = \frac{\text{Allowable frequencies when servo motor run without load}}{m + 1} \times \left(\frac{\text{Rated speed}}{\text{Operating speed}}\right)^2 \frac{\text{times}}{\text{min.}}$$

m = load/motor inertia ratio

User can select the adequate regenerative resistors according to the allowable frequencies by referring to the table below:

Allowable Frequencies (times/min)	ASMT□□L Series							ASMT□□M Series			
	100W	200W	400W	750W	1.0kW	2.0kW	3.0kW	1.0kW	1.5kW	2.0kW	3.0kW
	01	02	04	07	10	20	30	10	15	20	30
BR400W040	-	-	7137	2247	933	-	-	913	621	-	-
BR1K0W020	-	-	-	-	2333	1291	523	2282	1552	863	315

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6-6-4 Analog Monitor

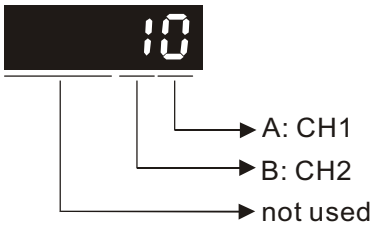
User can use analog monitor to observe the required analog voltage signals. ASDA-A series provide two analog channels, they are PIN No. 15 and 16 of CN1 connector. The parameters relative to analog monitor are shown below.

P0 - 03	MON	Analog Monitor Output	Communication Addr.: 0003H

Default: 01 Applicable Control Mode: P/S/T

Range: 00~55

Setting:



AB: (A: CH1; B: CH2)

0: Motor speed (+/-8 V/maximum rotation speed)

1: Motor torque (+/-8 V/maximum torque)

2: Pulse command frequency (+8 Volts /650Kpps)

3: Speed command (+/-8 Volts /maximum speed command)

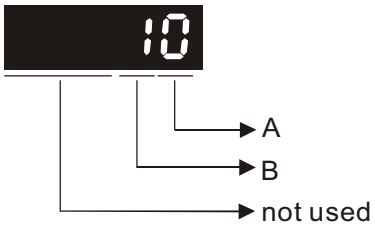
4: Torque command (+/-8 Volts /maximum torque command)

5: V_BUS voltage (+/-8 Volts /450V)

P1 - 03	AOUT	Output Polarity Setting	Communication Addr.: 0103H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~13



Monitor analog output polarity

- A=0: MON1(+), MON2(+)
- A=1: MON1(+), MON2(-)
- A=2: MON1(-), MON2(+)
- A=3: MON1(-), MON2(-)

Pulse output polarity

- B=0: Forward output
- B=1: Reverse output

P1 - 04	MON1	Analog Monitor Output Proportion 1 (CH1)	Communication Addr.: 0104H

Default: 100 Applicable Control Mode: P/S/T

Range: 0~100

Unit: %(full scale)

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P1 - 05	MON2	Analog Monitor Output Proportion 2 (CH2)	Communication Addr.: 0105H

Default: 100 Applicable Control Mode: P/S/T

Range: 0~100

Unit: %(full scale)

P4 - 20	DOF1	Offset Adjustment Value of Analog Monitor Output (CH1)	Communication Addr.: 0414H

Default: 0 Applicable Control Mode: P/S/T

Range: -800~800

Unit: mV

P4 - 21	DOF2	Offset Adjustment Value of Analog Monitor Output (CH2)	Communication Addr.: 0415H

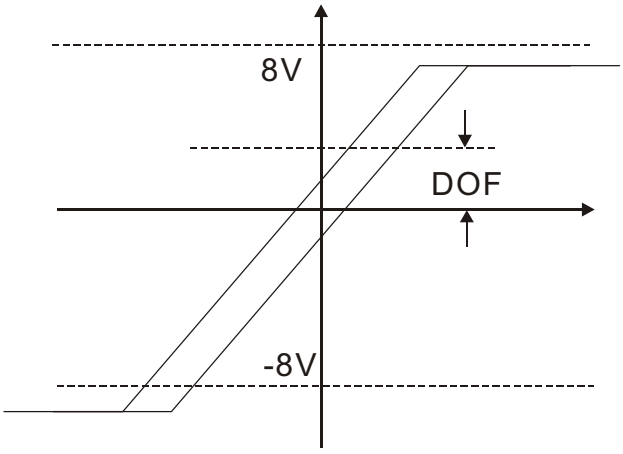
Default: 0 Applicable Control Mode: P/S/T

Range: -800~800

Unit: mV

For example, when user wants to observe the analog voltage signal of channel 1, if the monitor output setting range is 8V per 325Kpps, then it is needed to change the setting value of parameter P1-04 (Analog Monitor Output Proportion 1) to 50 (=325Kpps/Max. input frequency). Other related parameters setting include parameter P0-03 (X=3) and P1-03 (X=0~3, Output Polarity Setting). In general, when output voltage value of Ch1 is V_1, the pulse command frequency is equal to (Max. input frequency $\times V_1/8) \times$ P1-04/100.

Because there is an offset value of analog monitor output voltage, the zero voltage level of analog monitor output doesn't match to the zero point of setting value. We recommend users can use offset adjustment value of analog monitor output, DOF1 (parameter P4-20) and DOF2 (parameter P4-21) to improve this condition. The maximum output voltage range of analog monitor output is $\pm$8V. If the output voltage exceed its limit, it is still limited within the range of $\pm$8V. The revolution provided by ASDA-A series is 10bit, approximated to 13mv/LSB.



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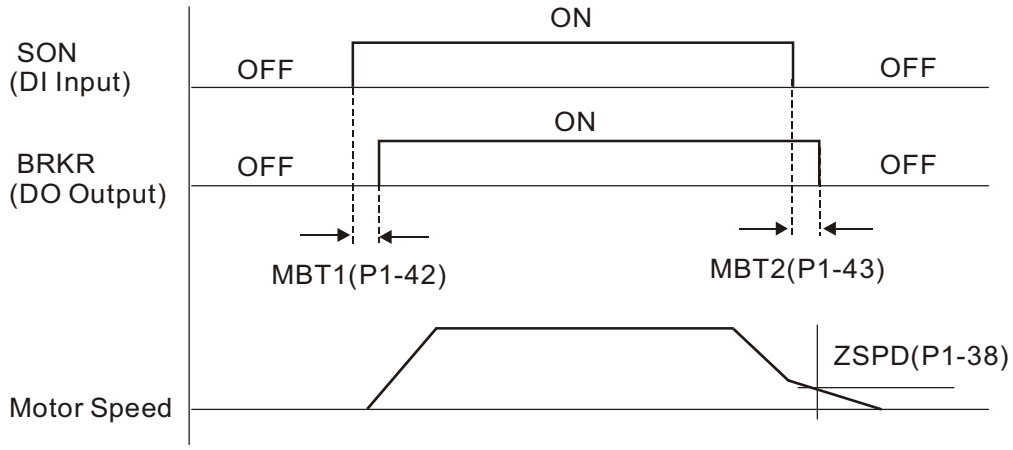
6-6-5 Electromagnetic Brake

When the servo drive is operating, if the BRKR is set to Off, it indicates the electromagnetic brake is disabled and motor is stop running and locked. If the BRKR is set to ON, it indicates electromagnetic brake is enabled and motor can run freely.

There are two setting methods of electromagnetic brake. One is using MBT1 (parameter P1-42) and the other is using MBT2 (parameter P1-43) to set the relevant time delay. The electromagnetic brake is usually used in perpendicular axis (Z-axis) and activated after the power is off. Using electromagnetic brake can avoid the load may slip since there is no motor holding torque when power is off. Without using electromagnetic brake may reduce the life of servo motor. To avoid malfunction, the electromagnetic brake should be activated after servo system is off (Servo Off).

If users desire to control electromagnetic brake by themselves, not by the servo drive, users must execute the function of electromagnetic brake during the servo motor is braking. The braking strength of motor and electromagnetic brake must be in the same direction during braking. Then, the servo drive will operate normally. However, the servo drive may generate greater current during acceleration or at constant speed and it may the cause of overload (servo fault).

Timing chart when user servo motor with electromagnetic brake:



BRKR output timing explanation:

1. After SERVO OFF, if reach the time set by P1-43 and the motor speed is still higher than the setting value of P1-38, BRKR output is OFF (electromagnetic brake interlock).
2. After SERVO OFF, if not reach the time set by P1-43 and the motor speed is lower than the setting value of P1-38, BRKR output is OFF (electromagnetic brake interlock).

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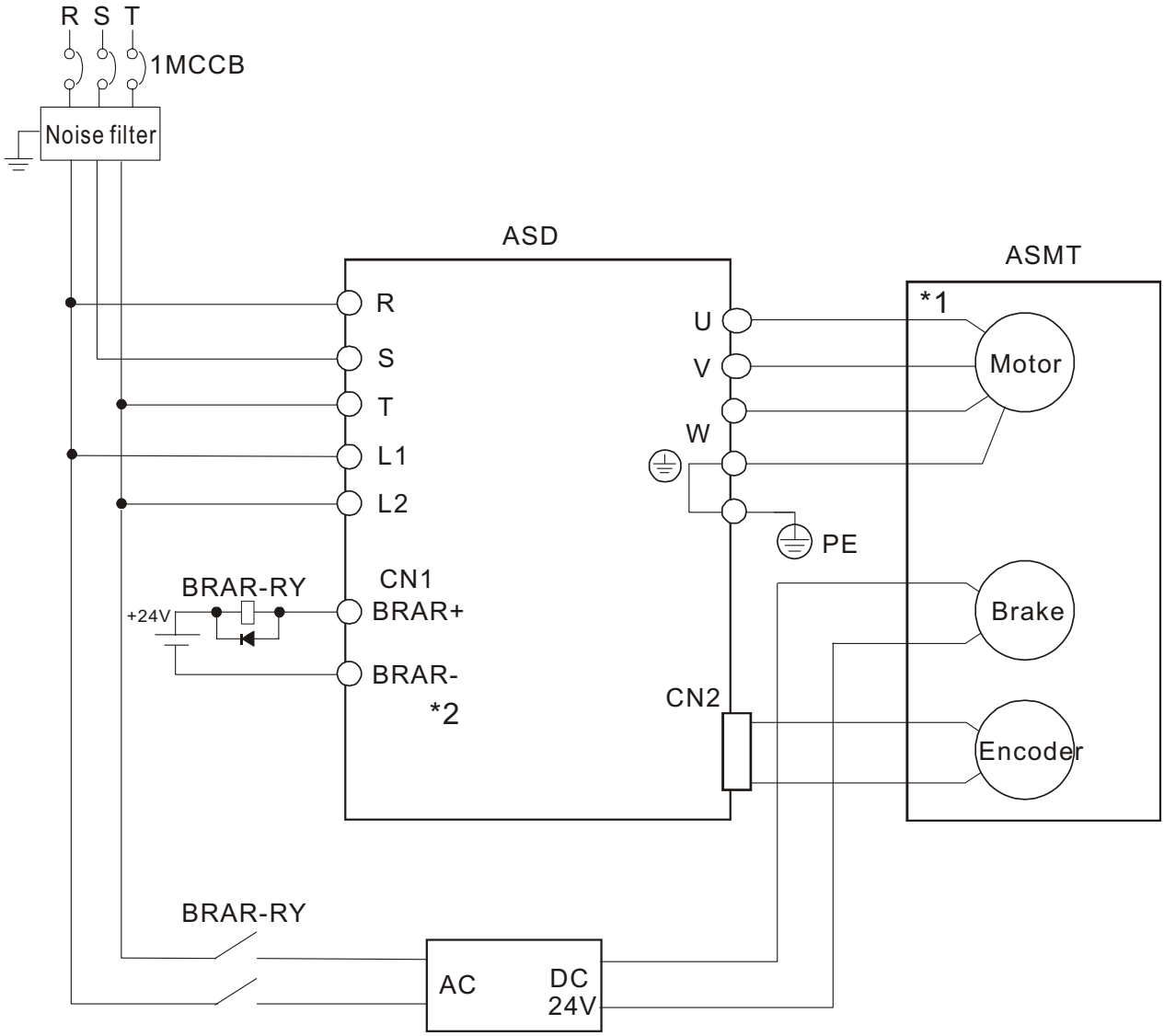
Electromagnetic Brake Wiring Diagram



*1: Please refer to Chapter 3 Configuration and Wiring

*2: BRKR-RY: Brake control relay

ASDA-A series servo drive provides the digital output signal (BRKR-RY). The BRKR-RY and the DC24V+ power supply complete a brake ON / OFF circuit.

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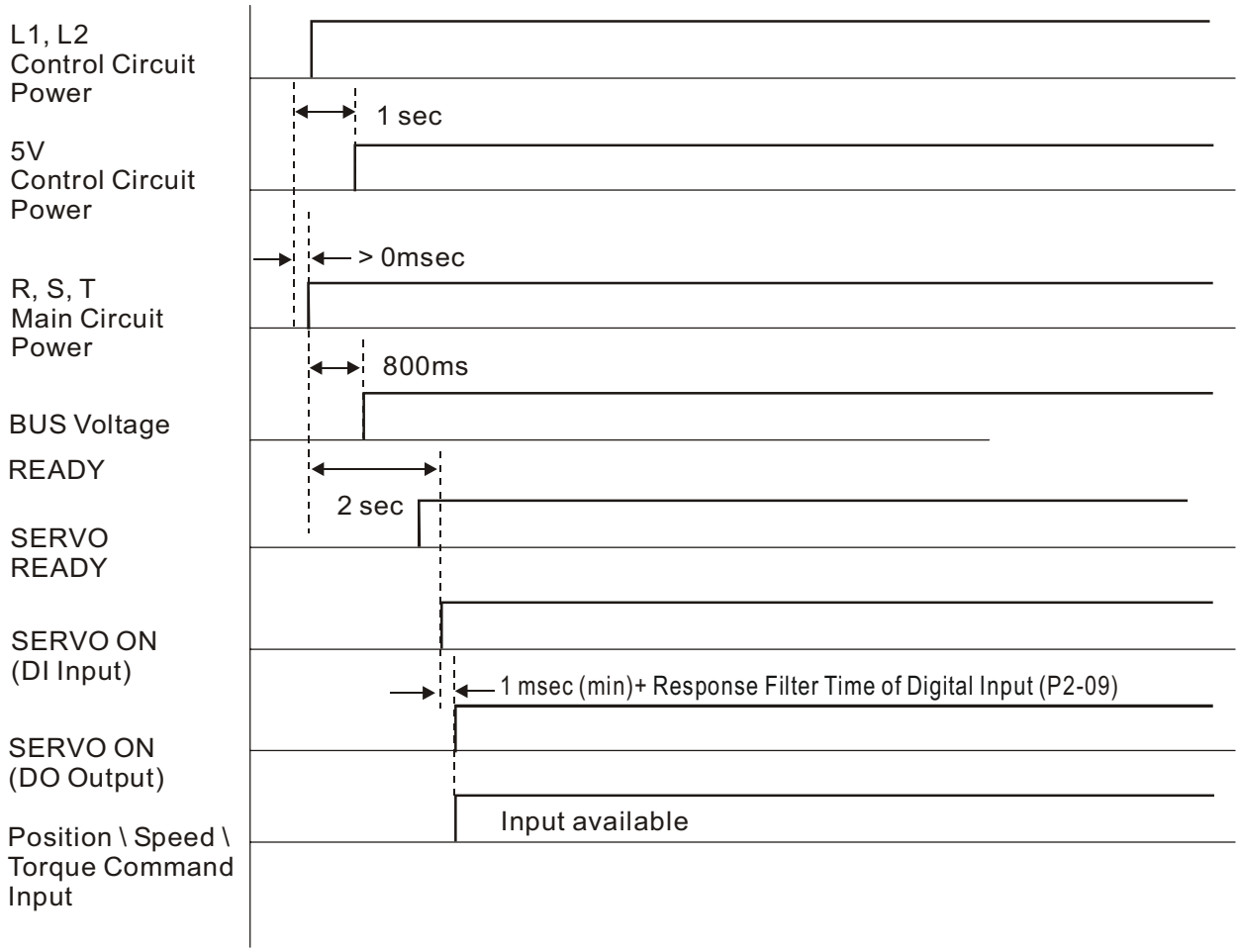
The timing charts of control circuit power and main circuit power:



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Chapter 7 Parameters

7-1 Definition

There are following five groups for parameters:

Group 0: Monitor parameter	(example: P0-xx)
Group 1: Basic parameter	(example: P1-xx)
Group 2: Extension parameter	(example: P2-xx)
Group 3: Communication parameter	(example: P3-xx)
Group 4: Diagnosis parameter	(example: P4-xx)

Abbreviation of control modes:

P : Position control mode

S : Speed control mode

T : Torque control mode

Explanation of symbols (marked after parameter)

(★) Read-only, read setting value only

(▲) Parameter can not be set when Servo On

(●) Parameter is effective after the servo drive is restarted (after switching power off and on).

(■) Setting value of the parameter is not memorized when power off

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7-2 Parameters Summary

7-2-1 Parameters List by Group

Group 0: P0-xx

Monitor Parameters							
Parameter	Name	Function	Default	Unit	Control Mode		
					P	S	T
P0-00★	VER	Software Version	Factory setting	---	O	O	O
P0-01★	ALE	Drive Fault Code	---	---	O	O	O
P0-02	STS	Drive Status	00	---	O	O	O
P0-03	MON	Analog Monitor Output	01	---	O	O	O
P0-04	CM1	Status Monitor 1	0	---	O	O	O
P0-05	CM2	Status Monitor 2	0	---	O	O	O
P0-06	CM3	Status Monitor 3	0	---	O	O	O
P0-07	CM4	Status Monitor 4	0	---	O	O	O
P0-08	CM5	Status Monitor 5	0	---	O	O	O
P0-09	MAP0	Block data read/write register 0	407H	---	O	O	O
P0-10	MAP1	Block data read/write register 1	10FH	---	O	O	O
P0-11	MAP2	Block data read/write register 2	110H	---	O	O	O
P0-12	MAP3	Block data read/write register 3	224H	---	O	O	O
P0-13	MAP4	Block data read/write register 4	111H	---	O	O	O
P0-14	MAP5	Block data read/write register 5	112H	---	O	O	O
P0-15	MAP6	Block data read/write register 6	225H	---	O	O	O
P0-16	MAP7	Block data read/write register 7	109H	---	O	O	O

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Group 1: P1-xx

Basic Parameters							
Parameter	Name	Function	Default	Unit	Control Mode		
					P	S	T
P1-00▲	PTT	External Pulse Input Type	2	---	O		
P1-01●	CTL	Control Mode and Output Direction	00	---	O	O	O
P1-02	PSTL	Speed and Torque Limit	00	---	O	O	O
P1-03	AOUT	Output Polarity Setting	0	---	O	O	O
P1-04	MON1	Analog Monitor Output Proportion 1 (CH1)	100	%	O	O	O
P1-05	MON2	Analog Monitor Output Proportion 2 (CH2)	100	%	O	O	O
P1-06	SFLT	Accel / Decel Smooth Constant of Analog Speed Command (Low-pass smooth filter)	0	msec		O	
P1-07	TFLT	Smooth Constant of Analog Torque Command (Low-pass smooth filter)	0	msec			O
P1-08	PFLT	Smooth Constant of Position Command (Low-pass smooth filter)	0	msec	O		
P1-09 ~ P1-11	SP1 ~ 3	1st ~ 3rd Speed Command 1st ~ 3rd Speed Limit	100~300	---		O	O
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Command 1st ~ 3rd Torque Limit	100	%	O	O	O
P1-15 ~ P1-30	PO1 ~ PO8	1st ~ 8th Position command for Rotation 1st ~ 8th Position command for Pulse	0	---	O		
P1-31	Reserved						
P1-32	LSTP	Motor Stop Mode Selection	0	---	O	O	O
P1-33●	POSS	Position Control Mode (Pr)	0	---	O		
P1-34	TACC	Acceleration Time	200	msec	O	O	
P1-35	TDEC	Deceleration Time	200	msec	O	O	
P1-36	TSL	Accel / Decel S-curve	0	msec	O	O	
P1-37	GDR	Ratio of Load Inertia to Servo Motor Inertia	5.0	times	O	O	O
P1-38	ZSPD	Zero Speed Level	10	rpm	O	O	O
P1-39	SSPD	Target Rotation Speed	3000	rpm	O	O	O
P1-40▲	VCM	Max. Analog Speed Command	rated	rpm	O	O	O
P1-41▲	TCM	Max. Analog Torque Command	100	%	O	O	O
P1-42	MBT1	On Delay Time of Electromagnetic Brake	20	ms	O	O	O
P1-43	MBT2	OFF Delay Time of Electromagnetic Brake	20	ms	O	O	O
P1-44▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	1	pulse	O		
P1-45▲	GR2	Electronic Gear Ratio (Denominator)	1	pulse	O		
P1-46▲	GR3	PG Dividing Output Pulse Ratio	1	---	O		
P1-47	HMOV	Homing Mode	0	---	O		
P1-48	HSPD1	1st Speed Setting of High Speed Homing	1000	rpm	O		
P1-49	HSPD2	2nd Speed Setting of Low Speed Homing	50	rpm	O		

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Basic Parameters							
Parameter	Name	Function	Default	Unit	Control Mode		
					P	S	T
P1-50	HOF1	Homing Offset Rotation Number	0	rev	O		
P1-51	HOF2	Homing Offset Pulse Number	0	pulse	O		
P1-52	RES1	Regenerative Resistor Value	---	Ohm	O	O	O
P1-53	RES2	Regenerative Resistor Capacity	---	Watt	O	O	O
P1-54	PER	Positioning Completed Width	100	pulse	O		
P1-55	MSPD	Maximum Speed Limit	rated	---	O	O	O
P1-56	OLW	Output Overload Warning	50	%	O	O	O

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Group 2: P2-xx

Extension Parameters							
Parameter	Name	Function	Default	Unit	Control Mode		
					P	S	T
P2-00	KPP	Proportional Position Loop Gain	35	rad/s	O		
P2-01	PPR	Position Gain Switching Rate	100	%	O		
P2-02	PFG	Position Feed Forward Gain	5000	0.0001	O		
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	msec	O		
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	O	O	
P2-05	SPR	Speed Gain Switching Rate	100	%	O	O	
P2-06	KVI	Speed Integral Compensation	100	---	O	O	
P2-07	KVF	Speed Feed Forward Gain	0	0.0001		O	
P2-08■	PCTL	Password	0	---	O	O	O
P2-09	DRT	Bounce Filter	2	2msec	O	O	O
P2-10	DI1	Digital Input Terminal 1 (DI1)	101	---	O	O	O
P2-11	DI2	Digital Input Terminal 2 (DI2)	116	---	O	O	O
P2-12	DI3	Digital Input Terminal 3 (DI3)	117	---	O	O	O
P2-13	DI4	Digital Input Terminal 4 (DI4)	0	---	O	O	O
P2-14	DI5	Digital Input Terminal 5 (DI5)	102	---	O	O	O
P2-15	DI6	Digital Input Terminal 6 (DI6)	22	---	O	O	O
P2-16	DI7	Digital Input Terminal 7 (DI7)	23	---	O	O	O
P2-17	DI8	Digital Input Terminal 8 (DI8)	21	---	O	O	O
P2-18	DO1	Digital Output Terminal 1 (DO1)	101	---	O	O	O
P2-19	DO2	Digital Output Terminal 2 (DO2)	103	---	O	O	O
P2-20	DO3	Digital Output Terminal 3 (DO3)	109	---	O	O	O
P2-21	DO4	Digital Output Terminal 4 (DO4)	105	---	O	O	O
P2-22	DO5	Digital Output Terminal 5 (DO5)	7	---	O	O	O
P2-23	NCF	Notch Filter Frequency of Resonance Suppression	1000	Hz	O	O	O
P2-24	DPH	Notch Filter Attenuation Ratio of Resonance Suppression	0	DB	O	O	O
P2-25	NLP	Low-pass Filter Time Constant of Resonance Suppression	2 or 5	msec	O	O	O
P2-26	DST	External Anti-Interference Gain	0	0.001	O	O	O
P2-27	GCC	Gain Switching Selection	0	---	O	O	
P2-28	GUT	Gain Switching Time Constant	10	10msec	O	O	
P2-29	GPE	Gain Switching Condition	10000	---	O	O	
P2-30■	INH	Auxiliary Function	0	---	O	O	O
P2-31	AUT1	Auto and Easy Mode Selection	44	---	O	O	O
P2-32▲	AUT2	Gain Adjustment Method	0	---	O	O	O
P2-33▲	INF	Easy Setting of Input Filter	0	---	O	O	O

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Extension Parameters							
Parameter	Name	Function	Default	Unit	Control Mode		
					P	S	T
P2-34	SDEV	Overspeed Warning Condition	5000	rpm		O	
P2-35	PDEV	Excessive Error Warning Condition	30000	pulse	O		
P2-36 ~ P2-43	POV1 ~ POV8	Moving Speed Setting of 1st ~ 8th Position	1000	rpm	O		
P2-44	DOM	Digital Output Modes	0	---	O		
P2-45	DOD	Combination Output Signal Delay Time	1	4msec	O		
P2-46	FSN	Feed Step Number	6	---	O		
P2-47	PED	Position Deviation Clear Delay Time	0	20msec	O		
P2-48	BLAS	Backlash Compensation of Feed Step Control	0	pulse	O		
P2-49	SJIT	Speed Detection Filter and Jitter Suppression	0	sec	O	O	
P2-50	CCLR	Pulse Clear Mode	0	---	O		
P2-51	SRON	Servo ON	0	---	O	O	O
P2-52	ATM0	Timer 0 of Auto Mode	0	sec	O		
P2-53	ATM1	Timer 1 of Auto Mode	0	sec	O		
P2-54	ATM2	Timer 2 of Auto Mode	0	sec	O		
P2-55	ATM3	Timer 3 of Auto Mode	0	sec	O		
P2-56	ATM4	Timer 4 of Auto Mode	0	sec	O		
P2-57	ATM5	Timer 5 of Auto Mode	0	sec	O		
P2-58	ATM6	Timer 6 of Auto Mode	0	sec	O		
P2-59	ATM7	Timer 7 of Auto Mode	0	sec	O		
P2-60	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	1	pulse	O		
P2-61	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	1	pulse	O		
P2-62	GR6	Electronic Gear Ratio (4th Numerator) (N4)	1	pulse	O		
P2-63	TSCA	Proportion Value Setting	0	times	O	O	
P2-64	TLMOD	Torque Limit Dual Mode	0	---		O	O

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Group 3: P3-xx

Communication Parameters							
Parameter	Name	Function	Default	Unit	Control Mode		
					P	S	T
P3-00	ADR	Communication Address	1	---	O	O	O
P3-01	BRT	Transmission Speed	1	bps	O	O	O
P3-02	PTL	Communication Protocol	0	---	O	O	O
P3-03	FLT	Transmission Fault Treatment	0	---	O	O	O
P3-04	CWD	Communication Time Out Detection	0	sec	O	O	O
P3-05	CMM	Communication Selection	0	---	O	O	O
P3-06■	SDI	Digital Input Contact Control	0	---	O	O	O
P3-07	CDT	Communication Response Delay Time	0	0.5msec	O	O	O

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Group 4: P4-xx

Diagnosis Parameters							
Parameter	Name	Function	Default	Unit	Control Mode		
					P	S	T
P4-00★	ASH1	Fault Record (N)	0	---	O	O	O
P4-01★	ASH2	Fault Record (N-1)	0	---	O	O	O
P4-02★	ASH3	Fault Record (N-2)	0	---	O	O	O
P4-03★	ASH4	Fault Record (N-3)	0	---	O	O	O
P4-04★	ASH5	Fault Record (N-4)	0	---	O	O	O
P4-05	JOG	JOG Operation	20	rpm	O	O	O
P4-06▲	FOT	Force Output	0	---	O	O	O
P4-07	ITST	Multi Function Digital Input	---	---	O	O	O
P4-08	PKEY	Digital Keypad Input of Servo Drive	---	---	O	O	O
P4-09	MOT	Multi Function Digital Output	---	---	O	O	O
P4-10▲	CEN	Adjustment Function	0	---	O	O	O
P4-11	SOF1	Analog Speed Input Offset 1	Factory setting	---	O	O	O
P4-12	SOF2	Analog Speed Input Offset 2	Factory setting	---	O	O	O
P4-13	TOF1	Analog Torque Input Offset 1	Factory setting	---	O	O	O
P4-14	TOF2	Analog Torque Input Offset 2	Factory setting	---	O	O	O
P4-15	COF1	Current Detector Offset (V1 phase)	Factory setting	---	O	O	O
P4-16	COF2	Current Detector Offset (V2 phase)	Factory setting	---	O	O	O
P4-17	COF3	Current Detector Offset (W1 phase)	Factory setting	---	O	O	O
P4-18	COF4	Current Detector Offset (W2 phase)	Factory setting	---	O	O	O
P4-19	TIGB	Adjustment Level of IGBT NTC	Factory setting	---	O	O	O
P4-20	DOF1	Offset Adjustment Value of Analog Monitor Output (CH1)	0	mV	O	O	O
P4-21	DOF2	Offset Adjustment Value of Analog Monitor Output (CH2)	0	mV	O	O	O
P4-22	SAO	Analog Speed Input Offset (Firmware)	0	mV		O	
P4-23	TAO	Analog Torque Input Offset (Firmware)	0	mV			O

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7-2-2 Parameters List by Function

Monitor and General Use								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P0-00★	VER	Software Version	Factory setting	---	O	O	O	---
P0-01★	ALE	Drive Fault Code	---	---	O	O	O	10-1
P0-02	STS	Drive Status	00	---	O	O	O	4-3-5
P0-03	MON	Analog Monitor Output	01	---	O	O	O	4-3-5
P0-04	CM1	Status Monitor 1	0	---	O	O	O	4-3-5
P0-05	CM2	Status Monitor 2	0	---	O	O	O	4-3-5
P0-06	CM3	Status Monitor 3	0	---	O	O	O	4-3-5
P0-07	CM4	Status Monitor 4	0	---	O	O	O	4-3-5
P0-08	CM5	Status Monitor 5	0	---	O	O	O	4-3-5
P0-09	MAP0	Block data read/write register 0	407H	---	O	O	O	---
P0-10	MAP1	Block data read/write register 1	10FH	---	O	O	O	---
P0-11	MAP2	Block data read/write register 2	110H	---	O	O	O	---
P0-12	MAP3	Block data read/write register 3	224H	---	O	O	O	---
P0-13	MAP4	Block data read/write register 4	111H	---	O	O	O	---
P0-14	MAP5	Block data read/write register 5	112H	---	O	O	O	---
P0-15	MAP6	Block data read/write register 6	225H	---	O	O	O	---
P0-16	MAP7	Block data read/write register 7	109H	---	O	O	O	---
P1-03	AOUT	Output Polarity Setting	0	---	O	O	O	3-3-3
P1-04	MON1	Analog Monitor Output Proportion 1 (CH1)	100	%	O	O	O	6-4-4
P1-05	MON2	Analog Monitor Output Proportion 2 (CH2)	100	%	O	O	O	6-4-4

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Smooth Filter and Resonance Suppression								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P1-06	SFLT	Accel / Decel Smooth Constant of Analog Speed Command (Low-pass smooth filter)	0	msec		O		6-3-3
P1-07	TFLT	Smooth Constant of Analog Torque Command (Low-pass smooth filter)	0	msec			O	6-4-3
P1-08	PFLT	Smooth Constant of Position Command (Low-pass smooth filter)	0	msec	O			6-2-6
P1-34	TACC	Acceleration Time	200	msec	O	O		6-3-3
P1-35	TDEC	Deceleration Time	200	msec	O	O		6-3-3
P1-36	TSL	Accel / Decel S-curve	0	msec	O	O		6-3-3
P2-23	NCF	Notch Filter Frequency of Resonance Suppression	1000	Hz	O	O	O	6-3-7
P2-24	DPH	Notch Filter Attenuation Ratio of Resonance Suppression	0	DB	O	O	O	6-3-7
P2-25	NLP	Low-pass Filter Time Constant of Resonance Suppression	2 or 5	msec	O	O	O	6-3-7
P2-33▲	INF	Easy Setting of Input Filter	0	---	O	O	O	6-3-6
P2-49	SJIT	Speed Detection Filter and Jitter Suppression	0	sec	O	O		---

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Gain and Switch								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P2-00	KPP	Proportional Position Loop Gain	35	rad/s	O			6-2-8
P2-01	PPR	Position Gain Switching Rate	100	%	O			---
P2-02	PFG	Position Feed Forward Gain	5000	0.0001	O			6-2-8
P2-03	PFF	Smooth Constant of Position Feed Forward Gain	5	msec	O			---
P2-04	KVP	Proportional Speed Loop Gain	500	rad/s	O	O		6-3-6
P2-05	SPR	Speed Gain Switching Rate	100	%	O	O		---
P2-06	KVI	Speed Integral Compensation	100	---	O	O		6-3-6
P2-07	KVF	Speed Feed Forward Gain	0	0.0001		O		6-3-6
P2-26	DST	External Anti-Interference Gain	0	0.001	O	O	O	---
P2-27	GCC	Gain Switching Selection	0	---	O	O		---
P2-28	GUT	Gain Switching Time Constant	10	10msec	O	O		----
P2-29	GPE	Gain Switching Condition	10000	---	O	O		----
P2-31	AUT1	Auto and Easy Mode Selection	44	---	O	O	O	6-3-6
P2-32▲	AUT2	Gain Adjustment Method	0	---	O	O	O	6-3-6

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Position Control								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P1-01●	CTL	Control Mode and Output Direction	00	---	O	O	O	6-1
P1-02	PSTL	Speed and Torque Limit	00	---	O	O	O	6-6
P1-55	MSPD	Maximum Speed Limit	rated	---	O	O	O	---
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Command (contact input torque control) 1st ~ 3rd Torque Limit (contact input torque control)	100	%	O	O	O	6-4-1
P1-46▲	GR3	PG Dividing Output Pulse Ratio	1	---	O			---
P2-50	CCLR	Pulse Clear Mode	0	---	O			----
External pulse control command (Pt mode)								
P1-00▲	PTT	External Pulse Input Type	2	---	O			6-2-1
P1-44▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	1	pulse	O			6-2-5
P1-45▲	GR2	Electronic Gear Ratio (Denominator)	1	pulse	O			6-3-6
P2-60	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	1	pulse	O			---
P2-61	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	1	pulse	O			---
P2-62	GR6	Electronic Gear Ratio (4th Numerator) (N4)	1	pulse	O			---
Internal pulse control command (Pr mode)								
P1-15 ~ P1-30	PO1 ~ PO8	1st ~ 8th Position Command for Rotation 1st ~ 8th Position Command for Pulse	0	---	O			6-2-2
P2-36 ~ P2-43	POV1 ~ POV8	Moving Speed Setting of 1st ~ 8th Position	1000	rpm	O			6-2-2
P1-33●	POSS	Position Control Mode (Pr)	0	---	O			6-2-2
P1-47	HMOV	Homing Mode	0	---	O			12-8
P1-48	HSPD1	1st Speed Setting of High Speed Homing	1000	rpm	O			12-8
P1-49	HSPD2	2nd Speed Setting of Low Speed Homing	50	rpm	O			12-8
P1-50	HOF1	Homing Offset Rotation Number	0	rev	O			---
P1-51	HOF2	Homing Offset Pulse Number	0	pulse	O			---
P2-44	DOM	Digital Output Modes	0	---	O			12-6
P2-45	DOD	Combination Output Signal Delay Time	1	4msec	O			12-6
P2-46	FSN	Feed Step Number	6	---	O			12-6
P2-47	PED	Position Deviation Clear Delay Time	0	20msec	O			12-6

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Position Control								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P2-48	BLAS	Backlash Compensation of Feed Step Control	0	pulse	O			12-6
P2-52	ATM0	Timer 0 of Auto Mode	0	sec	O			---
P2-53	ATM1	Timer 1 of Auto Mode	0	sec	O			---
P2-54	ATM2	Timer 2 of Auto Mode	0	sec	O			---
P2-55	ATM3	Timer 3 of Auto Mode	0	sec	O			---
P2-56	ATM4	Timer 4 of Auto Mode	0	sec	O			---
P2-57	ATM5	Timer 5 of Auto Mode	0	sec	O			---
P2-58	ATM6	Timer 6 of Auto Mode	0	sec	O			---
P2-59	ATM7	Timer 7 of Auto Mode	0	sec	O			---

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Speed Control								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P1-01●	CTL	Control Mode and Output Direction	00	---	O	O	O	6-1
P1-02	PSTL	Speed and Torque Limit	00	---	O	O	O	6-6
P1-46▲	GR3	PG Dividing Output Pulse Ratio	1	---	O			---
P1-55	MSPD	Maximum Speed Limit	rated	---	O	O	O	---
P1-09 ~ P1-11	SP1 ~ 3	1st ~ 3rd Speed Command 1st ~ 3rd Speed Limit	100~300	---		O	O	6-3-1
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Command 1st ~ 3rd Torque Limit	100	%	O	O	O	6-6-2
P1-40▲	VCM	Max. Analog Speed Command	rated	rpm		O		6-3-4
P1-41▲	TCM	Max. Analog Torque Command	100	%	O	O		---
P2-63	TSCA	Proportion Value Setting	0	times	O	O		---
P2-64	TLMOD	Torque Limit Dual Mode	0	---		O	O	---

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Torque Control								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P1-01●	CTL	Control Mode and Output Direction	00	---	O	O	O	6-1
P1-02	PSTL	Speed and Torque Limit	00	---	O	O	O	6-6
P1-55	MSPD	Maximum Speed Limit	rated	---	O	O	O	---
P1-09 ~ P1-11	SP1 ~ 3	1st ~ 3rd Speed Command 1st ~ 3rd Speed Limit	100~300	---		O	O	6-6-1
P1-12 ~ P1-14	TQ1 ~ 3	1st ~ 3rd Torque Command 1st ~ 3rd Torque Limit	100	%	O	O	O	6-4-1
P1-40▲	VCM	Max. Analog Speed Command	rated	rpm	O		O	---
P1-41▲	TCM	Max. Analog Torque Command	100	%			O	---

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Digital I/O and relative input output setting

Digital I/O								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P2-09	DRT	Bounce Filter	2	2msec	O	O	O	Table 7.A
P2-10	DI1	Digital Input Terminal 1 (DI1)	101	---	O	O	O	
P2-11	DI2	Digital Input Terminal 2 (DI2)	116	---	O	O	O	
P2-12	DI3	Digital Input Terminal 3 (DI3)	117	---	O	O	O	
P2-13	DI4	Digital Input Terminal 4 (DI4)	0	---	O	O	O	
P2-14	DI5	Digital Input Terminal 5 (DI5)	102	---	O	O	O	
P2-15	DI6	Digital Input Terminal 6 (DI6)	22	---	O	O	O	
P2-16	DI7	Digital Input Terminal 7 (DI7)	23	---	O	O	O	
P2-17	DI8	Digital Input Terminal 8 (DI8)	21	---	O	O	O	
P2-18	DO1	Digital Output Terminal 1 (DO1)	101	---	O	O	O	Table 7.B
P2-19	DO2	Digital Output Terminal 2 (DO2)	103	---	O	O	O	
P2-20	DO3	Digital Output Terminal 3 (DO3)	109	---	O	O	O	
P2-21	DO4	Digital Output Terminal 4 (DO4)	105	---	O	O	O	
P2-22	DO5	Digital Output Terminal 5 (DO5)	7	---	O	O	O	
P1-38	ZSPD	Zero Speed Level	10	rpm	O	O	O	---
P1-39	SSPD	Target Rotation Speed	3000	rpm	O	O	O	---
P1-42	MBT1	On Delay Time of Electromagnetic Brake	20	ms	O	O	O	6-5-5
P1-43	MBT2	OFF Delay Time of Electromagnetic Brake	20	ms	O	O	O	6-5-5
P1-54	PER	Positioning Completed Width	100	pulse	O			---
P1-56	OLW	Output Overload Warning	50	%	O	O	O	---

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Communication								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P3-00	ADR	Communication Address	1	---	O	O	O	8-2
P3-01	BRT	Transmission Speed	1	bps	O	O	O	8-2
P3-02	PTL	Communication Protocol	0	---	O	O	O	8-2
P3-03	FLT	Transmission Fault Treatment	0	---	O	O	O	8-2
P3-04	CWD	Communication Time Out Detection	0	sec	O	O	O	8-2
P3-05	CMM	Communication Selection	0	---	O	O	O	8-2
P3-06■	SDI	Digital Input Contact Control	0	---	O	O	O	8-2
P3-07	CDT	Communication Response Delay Time	0	0.5msec	O	O	O	---

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Diagnosis								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P4-00★	ASH1	Fault Record (N)	0	---	O	O	O	4-4-1
P4-01★	ASH2	Fault Record (N-1)	0	---	O	O	O	4-4-1
P4-02★	ASH3	Fault Record (N-2)	0	---	O	O	O	4-4-1
P4-03★	ASH4	Fault Record (N-3)	0	---	O	O	O	4-4-1
P4-04★	ASH5	Fault Record (N-4)	0	---	O	O	O	4-4-1
P4-05	JOG	JOG Operation	20	rpm	O	O	O	4-4-2
P4-06▲	FOT	Force Output	0	---	O	O	O	4-4-4
P4-07	ITST	Multi Function Digital Input	---	---	O	O	O	4-4-5
P4-08	PKEY	Digital Keypad Input of Servo Drive	---	---	O	O	O	---
P4-09	MOT	Multi Function Digital Output	---	---	O	O	O	4-4-6
P4-10▲	CEN	Adjustment Function	0	---	O	O	O	---
P4-11	SOF1	Analog Speed Input Offset 1	Factory setting	---	O	O	O	---
P4-12	SOF2	Analog Speed Input Offset 2	Factory setting	---	O	O	O	---
P4-13	TOF1	Analog Torque Input Offset 1	Factory setting	---	O	O	O	---
P4-14	TOF2	Analog Torque Input Offset 2	Factory setting	---	O	O	O	---
P4-15	COF1	Current Detector Offset (V1 phase)	Factory setting	---	O	O	O	---
P4-16	COF2	Current Detector Offset (V2 phase)	Factory setting	---	O	O	O	---
P4-17	COF3	Current Detector Offset (W1 phase)	Factory setting	---	O	O	O	---
P4-18	COF4	Current Detector Offset (W2 phase)	Factory setting	---	O	O	O	---
P4-19	TIGB	Adjustment Level of IGBT NTC	Factory setting	---	O	O	O	---
P4-20	DOF1	Offset Adjustment Value of Analog Monitor Output (CH1)	0	mV	O	O	O	6-4-4
P4-21	DOF2	Offset Adjustment Value of Analog Monitor Output (CH2)	0	mV	O	O	O	6-4-4
P4-22	SAO	Analog Speed Input Offset (Firmware)	0	mV		O		---
P4-23	TAO	Analog Torque Input Offset (Firmware)	0	mV			O	---

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Others								
Parameter	Name	Function	Default	Unit	Control Mode			Related Section
					P	S	T	
P1-31	Reserved							
P1-32	LSTP	Motor Stop Mode Selection	0	---	O	O	O	---
P1-37	GDR	Ratio of Load Inertia to Servo Motor Inertia	5.0	times	O	O	O	---
P1-52	RES1	Regenerative Resistor Value	---	Ohm	O	O	O	6-6-3
P1-53	RES2	Regenerative Resistor Capacity	---	Watt	O	O	O	6-6-3
P2-08■	PCTL	Password	0	---	O	O	O	---
P2-30■	INH	Auxiliary Function	0	---	O	O	O	---
P2-34	SDEV	Overspeed Warning Condition	5000	rpm		O		---
P2-35	PDEV	Excessive Error Warning Condition	30000	pulse	O			---
P2-51	SRON	Servo ON	0	---	O	O	O	12-6
P2-63	TSCA	Proportion Value Setting	0	times	O	O		---

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7-3 Detailed Parameter Listings

Group 0: P0-xx Monitor Parameters

P0 - 00★	VER	Software Version	Communication Addr.: 0000H

Default: Factory setting — Applicable Control Mode: P/S/T

P0 - 01★	ALE	Drive Fault Code	Communication Addr.: 0001H

Range: 00~22 — Applicable Control Mode: P/S/T

Setting:

01: Overcurrent
02: Overvoltage
03: Undervoltage
04: Motor overheated
05: Regeneration error
06: Overload
07: Overspeed
08: Abnormal pulse control command
09: Excessive deviation
10: Watch dog fault
11: Position detector fault
12: Adjustment error
13: Emergency stop
14: Reverse limit error
15: Forward limit error
16: IGBT temperature error
17: Memory error
18: DSP communication error
19: Serial communication error
20: Serial communication time out
21: DSP to MCU command write-in error
22: Input power phase loss

P0 - 02	STS	Drive Status	Communication Addr.: 0002H

Default: 00 — Applicable Control Mode: P/S/T

Range: 00~16

Setting:

00: Motor feedback pulse number (absolute value)
01: Motor feedback rotation number (absolute value)
02: Pulse count of pulse command

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03: Rotation number of pulse command

04: Position error counter [pulse]

05: Input frequency of pulse command [kHz]

06: Motor rotation speed [rpm]

07: Speed input command [Volt]

08: Speed input command [rpm]

09: Torque input command [Volt]

10: Torque input command [N-M]

11: Average load [%]

12: Peak load [%]

13: Main circuit voltage

14: Ratio of load inertia to Motor inertia

15: Motor feedback pulse number (relative value)

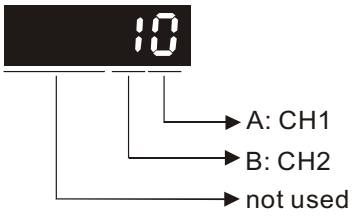
16: Motor feedback pulse number (relative value)

P0 - 03	MON	Analog Monitor Output	Communication Addr.: 0003H

Default: 01 Applicable Control Mode: P/S/T

Range: 00~55

Setting:



AB: (A: CH1; B: CH2)

0: Motor speed (+/-8 V/maximum rotation speed)

1: Motor torque (+/-8 V/maximum torque)

2: Pulse command frequency (+8 Volts /650Kpps)

3: Speed command (+/-8 Volts /maximum speed command)

4: Torque command (+/-8 Volts /maximum torque command)

5: V_BUS voltage (+/-8 Volts /450V)

Note: For the setting of analog output voltage proportion, refer to the P1-04 and P1-05

Example:

P0-03 = 01(CH1 is speed analog output)

Motor rotation speed = (Max. rotation speed × V1/8) × P1-04/100, when the output voltage value of CH1 is V1.

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P0 - 04	CM1	Status Monitor 1	Communication Addr.: 0004H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~16

Select the desired drive status through the keypad or communication setting (please refer to P0-02). The drive status can be read from the communication address of this parameter via communication port.

P0 - 05	CM2	Status Monitor 2	Communication Addr.: 0005H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~16

See P0-04 for explanation.

P0 - 06	CM3	Status Monitor 3	Communication Addr.: 0006H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~16

See P0-04 for explanation.

P0 - 07	CM4	Status Monitor 4	Communication Addr.: 0007H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~17

If users set this parameter to 17, the status of DI signal can be read.

See P0-04 for explanation.

P0 - 08	CM5	Status Monitor 5	Communication Addr.: 0008H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~17

If users set this parameter to 17, the status of DO signal can be read.

See P0-04 for explanation.

P0 - 09	MAP0	Block Data Read/Write Register 0	Communication Addr.: 0009H

Default: 407H Applicable Control Mode: P/S/T

Range: 100H~417H

Set the register address in HEX that users want to read and write by using the keypad. Users can enter the desired register address (0100H~0417H) into P0-09 to P0-16 (0009H~0010H). Then, users can read and write up to 8 continuous specified block data from the communication address 0009H to 0010H through the communication port.

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P0 - 10	MAP1	Block Data Read/Write Register 1	Communication Addr.: 000AH

Default: 10FH Applicable Control Mode: P/S/T

Range: 100H~417H

See P0-09 for explanation.

P0 - 11	MAP2	Block Data Read/Write Register 2	Communication Addr.: 000BH

Default: 110H Applicable Control Mode: P/S/T

Range: 100H~417H

See P0-09 for explanation.

P0 - 12	MAP3	Block Data Read/Write Register 3	Communication Addr.: 000CH

Default: 224H Applicable Control Mode: P/S/T

Range: 100H~417H

See P0-09 for explanation.

P0 - 13	MAP4	Block Data Read/Write Register 4	Communication Addr.: 000DH

Default: 111H Applicable Control Mode: P/S/T

Range: 100H~417H

See P0-09 for explanation.

P0 - 14	MAP5	Block Data Read/Write Register 5	Communication Addr.: 000EH

Default: 112H Applicable Control Mode: P/S/T

Range: 100H~417H

See P0-09 for explanation.

P0 - 15	MAP6	Block Data Read/Write Register 6	Communication Addr.: 000FH

Default: 225H Applicable Control Mode: P/S/T

Range: 100H~417H

See P0-09 for explanation.

P0 - 16	MAP7	Block Data Read/Write Register 7	Communication Addr.: 0010H

Default: 109H Applicable Control Mode: P/S/T

Range: 100H~417H

See P0-09 for explanation.

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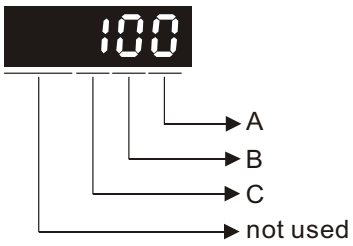
Group 1: P1-xx Basic Parameters

P1 - 00▲	PTT	External Pulse Input Type	Communication Addr.: 0100H

Default: 2 Applicable Control Mode: P

Range: 0~132

Setting:



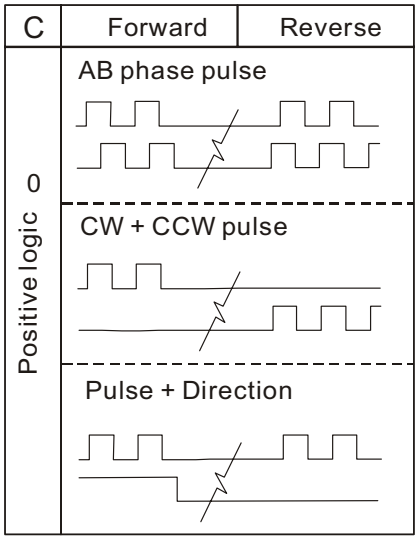
Value A: pulse type

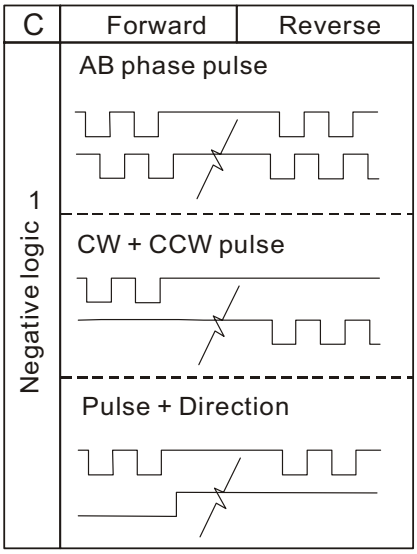
- A=0: AB phase pulse (4x)
  A=1: CW + CCW pulse
  A=2: Pulse + Direction
- Other setting: Reversed

Input pulse interface	Max. Input pulse frequency
Line driver	500kpps
Open collector	200kpps

Reserved setting value of B: 0

Value C: Logic type





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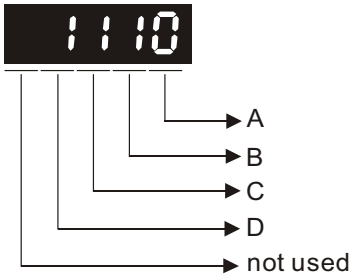
P1 - 01●	CTL	Control Mode and Output Direction	Communication Addr.: 0101H

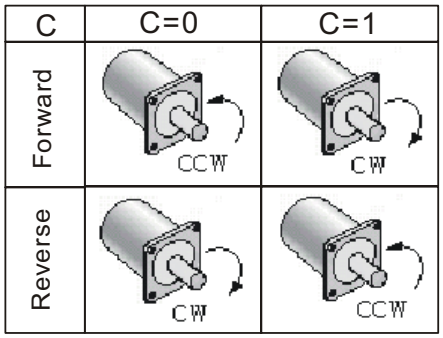
Default: 00 Applicable Control Mode: P/S/T

Range: 00~1110

Unit: pulse (Position mode), rpm(Speed mode), N.M(Torque mode)



- BA=10: Control mode setting
- C: Torque output direction control
- D=1: When switching to different mode, DIO (P2-10~P1-22) can be reset to be the default value of the mode you switch to.
  D=0: When switching to different mode, the setting value of DIO (P2-10~P1-22) will remain the same and will not be changed.



Mode	Pt	Pr	S	T	Sz	Tz
00	▲					
01		▲				
02			▲			
03				▲		
04					▲	
05						▲
06	▲		▲			
07	▲			▲		
08		▲	▲			
09		▲		▲		
10			▲	▲		

- Pt: Position control mode (command from external signal)
- Pr: Position control mode (command from internal signal)
- S: Speed control mode (external signal / internal signal)
- T: Torque control mode (external signal / internal signal)
- Sz: Zero speed / internal speed command
- Tz: Zero torque / internal torque command

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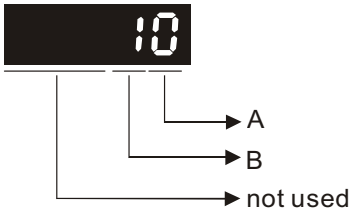
P1 - 02▲	PSTL	Speed and Torque Limit	Communication Addr.: 0102H

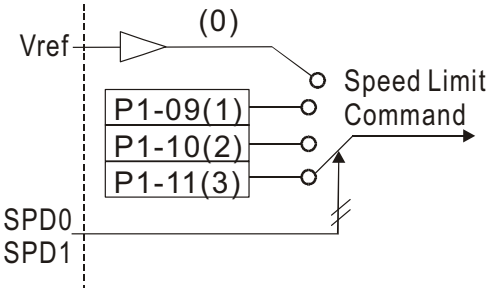
Default: 00 Applicable Control Mode: P/S/T

Range: 00~11



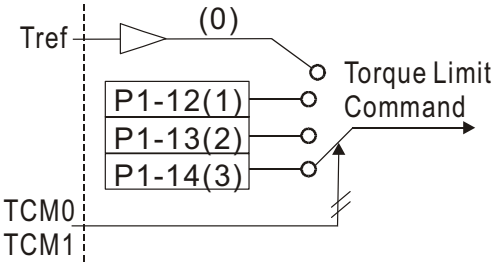
- A=0: Disable speed limit function

  A=1: Enable speed limit function (It is available in torque mode)



- Other: Reserved
- B=0: Disable torque limit function

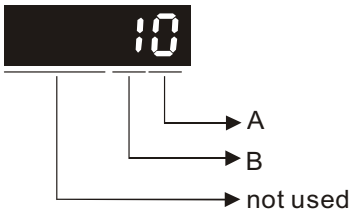
  B=1: Enable torque limit function (It is available in position and speed mode)



P1 - 03	AOUT	Output Polarity Setting	Communication Addr.: 0103H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~13



Monitor analog output polarity

- A=0: MON1(+), MON2(+)
- A=1: MON1(+), MON2(-)
- A=2: MON1(-), MON2(+)
- A=3: MON1(-), MON2(-)

Pulse output polarity

- B=0: Forward output
- B=1: Reverse output

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P1 - 04	MON1	Analog Monitor Output Proportion 1 (CH1)	Communication Addr.: 0104H

Default: 100 Applicable Control Mode: P/S/T

Range: 0~100

Unit: %(full scale)

P1 - 05	MON2	Analog Monitor Output Proportion 2 (CH2)	Communication Addr.: 0105H

Default: 100 Applicable Control Mode: P/S/T

Range: 0~100

Unit: %(full scale)

P1 - 06	SFLT	Accel / Decel Smooth Constant of Analog Speed Command (Low-pass filter)	Communication Addr.: 0106H

Default: 0 Applicable Control Mode: S

Range: 0~1000 (0: Disabled)

Unit: msec

P1 - 07	TFLT	Smooth Constant of Analog Torque Command (Low-pass smooth filter)	Communication Addr.: 0107H

Default: 0 Applicable Control Mode: T

Range: 0~100 (0: Disabled)

Unit: msec

P1 - 08	PFLT	Smooth Constant of Position Command (Low-pass filter)	Communication Addr.: 0108H

Default: 0 Applicable Control Mode: P

Range: 0~1000 (0: Disabled)

Unit: 10 msec

P1 - 09	SP1	1st Speed Command 1st Speed Limit	Communication Addr.: 0109H

Default: 100 Applicable Control Mode: S

Range: +/-5000

Unit: r/min

1st Speed Command

In Speed mode, this parameter is used to set speed 1 of internal speed command. For the decimal place setting of internal speed command, please refer to P2-63.

Default: 100 Applicable Control Mode: T

Range: +/-5000

Unit: r/min

1st Speed Limit

In Torque mode, this parameter is used to set speed limit 1 of internal speed command.

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P1 - 10	SP2	2nd Speed Command 2nd Speed Limit	Communication Addr.: 010AH

Default: 200 Applicable Control Mode: S

Range: +/-5000

Unit: r/min

2nd Speed Command

In Speed mode, this parameter is used to set speed 2 of internal speed command. For the decimal place setting of internal speed command, please refer to P2-63.

Default: 200 Applicable Control Mode: T

Range: +/-5000

Unit: r/min

2nd Speed Limit

In Torque mode, this parameter is used to set speed limit 2 of internal speed command.

P1 - 11	SP3	3rd Speed Command 3rd Speed Limit	Communication Addr.: 010BH

Default: 300 Applicable Control Mode: S

Range: +/-5000

Unit: r/min

3rd Speed Command

In Speed mode, this parameter is used to set speed 3 of internal speed command. For the decimal place setting of internal speed command, please refer to P2-63.

Default: 300 Applicable Control Mode: T

Range: +/-5000

Unit: r/min

3rd Speed Limit

In Torque mode, this parameter is used to set speed limit 3 of internal speed command.

P1 - 12	TQ1	1st Torque Command 1st Torque Limit	Communication Addr.: 010CH

Default: 100 Applicable Control Mode: T

Range: +/-300

Unit: %

1st Torque Command

In Torque mode, this parameter is used to set torque 1 of internal torque command.

Default: 100 Applicable Control Mode: P/S

Range: +/-300

Unit: %

1st Torque Limit

In Position and Speed mode, this parameter is used to set torque limit 1 of internal torque command.

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Digital output signal TQL is activated when the drive has detected that the motor has reached the torques limits set by either the parameters P1-12 ~ P1-14 of via an external analog voltage.

P1 - 13	TQ2	2nd Torque Command 2nd Torque Limit	Communication Addr.: 010DH

Default: 100 Applicable Control Mode: T

Range: +/-300

Unit: %

2nd Torque Command

In Torque mode, this parameter is used to set torque 2 of internal torque command.

Default: 100 Applicable Control Mode: P/S

Range: +/-300

Unit: %

2nd Torque Limit

In Position and Speed mode, this parameter is used to set torque limit 2 of internal torque command.

Digital output signal TQL is activated when the drive has detected that the motor has reached the torques limits set by either the parameters P1-12 ~ P1-14 of via an external analog voltage.

P1 - 14	TQ3	3rd Torque Command 3rd Torque Limit	Communication Addr.: 010EH

Default: 100 Applicable Control Mode: T

Range: +/-300

Unit: %

3rd Torque Command

In Torque mode, this parameter is used to set torque 3 of internal torque command.

Default: 100 Applicable Control Mode: P/S

Range: +/-300

Unit: %

3rd Torque Limit

In Position and Speed mode, this parameter is used to set torque limit 3 of internal torque command.

Digital output signal TQL is activated when the drive has detected that the motor has reached the torques limits set by either the parameters P1-12 ~ P1-14 of via an external analog voltage.

P1 - 15	PO1H	1st Position Command for Rotation	Communication Addr.: 010FH

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation cycle number of internal position 1.

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P1 - 16	PO1L	1st Position Command for Pulse	Communication Addr.: 0110H

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation pulse number of internal position 1.

Stroke1 = PO1H × (cnt/rev) + PO1L

P1 - 17	PO2H	2nd Position Command for Rotation	Communication Addr.: 0111H

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation pulse number of internal position 2.

P1 - 18	PO2L	2nd Position Command for Pulse	Communication Addr.: 0112H

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation cycle number of internal position 2.

Stroke2 = PO2H × (cnt/rev) + PO2L

P1 - 19	PO3H	3rd Position Command for Rotation	Communication Addr.: 0113H

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation pulse number of internal position 3.

P1 - 20	PO3L	3rd Position Command for Pulse	Communication Addr.: 0114H

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation cycle number of internal position 3.

Stroke3 = PO3H × (cnt/rev) + PO3L

P1 - 21	PO4H	4th Position Command for Rotation	Communication Addr.: 0115H

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation pulse number of internal position 4.

P1 - 22	PO4L	4th Position Command for Pulse	Communication Addr.: 0116H

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation cycle number of internal position 4.

Stroke4 = PO4H × (cnt/rev) + PO4L

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P1 - 23	PO5H	5th Position Command for Rotation	Communication Addr.: 0117H

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation pulse number of internal position 5.

P1 - 24	PO5L	5th Position Command for Pulse	Communication Addr.: 0118H

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation cycle number of internal position 5.

Stroke5 = PO5H × (cnt/rev) + PO5L

P1 - 25	PO6H	6th Position Command for Rotation	Communication Addr.: 0119H

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation pulse number of internal position 6.

P1 - 26	PO6L	6th Position Command for Pulse	Communication Addr.: 011AH

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation cycle number of internal position 6.

Stroke6 = PO6H × (cnt/rev) + PO6L

P1 - 27	PO7H	7th Position Command for Rotation	Communication Addr.: 011BH

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation cycle number of internal position 7.

P1 - 28	PO7L	7th Position Command for Pulse	Communication Addr.: 011CH

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation pulse number of internal position 7.

Stroke7 = PO7H × (cnt/rev) + PO7L

P1 - 29	PO8H	8th Position Command for Rotation	Communication Addr.: 011DH

Default: 0 Applicable Control Mode: Pr

Range: +/-30000

This parameter is used to set rotation cycle number of internal position 8.

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P1 - 30	PO8L	8th Position Command for Pulse	Communication Addr.: 011EH

Default: 0 Applicable Control Mode: Pr

Range: +/-max. cnt/rev

This parameter is used to set rotation pulse number of internal position 8.

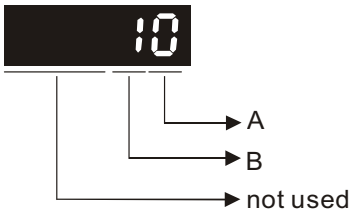
Stroke8 = PO8H × (cnt/rev) + PO8L

P1 - 31	Reversed

P1 - 32	LSTP	Motor Stop Mode Selection	Communication Addr.: 0120H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~11



- B=0: When the servo drive is OFF, execute dynamic brake
- B=1: When the servo drive is OFF, servo motor free run

When a fault occurs (CWL, CCWL, EMGS and serial communication error), this parameter is used to select servo motor stop mode.

- A=0: Stop instantly
- A=1: Decelerate to stop

P1 - 33●	POSS	Position Control Mode (Pr)	Communication Addr.: 0121H

Default: 0 Applicable Control Mode: P

Range: 0~6

0: Absolute position command

1: Incremental position command

2: Forward operation search feed step

3: Reverse operation search feed step

4: Short-pass search feed step

5: Continuous auto-running position command (Absolute)

6: Continuous auto-running position command (Incremental)

7: One-cycle auto-running position command (Absolute)

8: One-cycle auto-running position command (Incremental)

This function when changed from absolute to incremental or incremental to absolute only gets registered in the drive after switching power off and on.

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P1 - 34	TACC	Acceleration Time	Communication Addr.: 0122H

Default: 200 Applicable Control Mode: P/S

Range: 1~20000

Unit: msec

1st to 3rd step Acceleration time.

It is used to determine the acceleration time to accelerate from 0 to its rated rotation speed.

(When P1-36 is set to 0: Accel/Decel function is disabled, i.e. P1-34, P1-35 is disabled)

P1 - 35	TDEC	Deceleration Time	Communication Addr.: 0123H

Default: 200 Applicable Control Mode: Pr/S

Range: 1~20000

Unit: msec

1st to 3rd step Deceleration time.

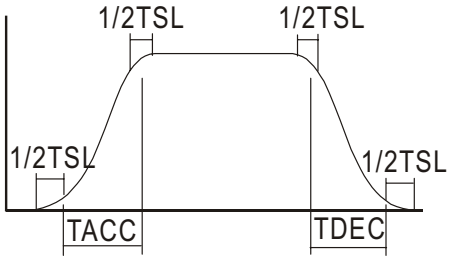
It is used to determine the deceleration time to decelerate from its rated rotation speed to 0.

P1 - 36	TSL	Accel /Decel S-curve	Communication Addr.: 0124H

Default: 0 Applicable Control Mode: P/S

Range: 0~10000 (0: Disabled)

Unit: msec



TACC: Acceleration time

TDEC: Deceleration time

Total acceleration time = TACC + TSL

Total deceleration time = TDEC + TSL

P1 - 37	TDEC	Ratio of Load Inertia to Servo Motor Inertia	Communication Addr.: 0125H

Default: 5.0 Applicable Control Mode: P/S/T

Range: 0~200.0

Unit: times

Ratio of load inertia to servo motor inertia: (J_load /J_motor)

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P1 - 38	ZSPD	Zero Speed Level	Communication Addr.: 0126H

Default: 10 Applicable Control Mode: P/S/T

Range: 0~200

Unit: rpm

Used to set output range of zero speed signal (ZSPD).

ZSPD is activated when the drive senses the motor is equal to or below the Zero Speed Range setting as defined in parameter P1-38.

For Example, at default ZSPD will be activated when the drive detects the motor rotating at speed at or below 10 rpm. ZSPD will remain activated until the motor speed increases above 10 RPM.

P1 - 39	SSPD	Target Rotation Speed	Communication Addr.: 0127H

Default: 3000 Applicable Control Mode: P/S/T

Range: 0~5000

Unit: rpm

When target rotation speed reaches its preset value, digital output (TSPD) is enabled. When the forward and reverse speed of servo motor is higher than the setting value, the motor will reach the target rotation speed, and then TSPD signal will output.

TSPD is activated once the drive has detected the motor has reached the Target Rotation Speed setting as defined in parameter P1-39. TSPD will remain activated until the motor speed drops below the Target Rotation Speed.

P1 - 40▲	VCM	Max. Analog Speed Command	Communication Addr.: 0128H

Default: rated Applicable Control Mode: S

Range: 0~10000

Unit: rpm

In Speed mode, this parameter is used to set the speed at the maximum input voltage (10V) of the analog speed command. For example, if P1-40 is set to 3000 and the input voltage is 10V, it indicates that the speed command is 3000rpm. If P1-40 is set to 3000, but the input voltage is changed to 5V, then the speed command is changed to 1500rpm.

Speed command = Input voltage x setting/10

Default: rated Applicable Control Mode: P/T

Range: 0~10000

Unit: rpm

In Position and Torque mode, this parameter is used to set the speed at the maximum input voltage (10V) of the analog speed limit.

Speed limit command = Input voltage x setting/10

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P1 - 41▲	TCM	Max. Analog Torque Command	Communication Addr.: 0129H

Default: 100 Applicable Control Mode: T

Range: 0~1000

Unit: %

In Torque mode, this parameter is used to set the output torque at maximum input voltage (10V) of analog torque command. For example, if P1-41 is set to 100 and the input voltage is 10V, it indicates that the torque command is 100% rated torque. If P1-41 is set to 100, but the input voltage is changed to 5V, then the torque command is changed to 50% rated torque.

Torque command = Input voltage x setting/10 (%)

Default: 100 Applicable Control Mode: P/S

Range: 0~1000

Unit: %

In Position and Speed mode, this parameter is used to set output torque at maximum input voltage (10V) of analog torque limit

Torque limit command = Input voltage x setting/10 (%)

P1 - 42	MBT1	On Delay Time of Electromagnetic Brake	Communication Addr.: 012AH

Default: 20 Applicable Control Mode: P/S/T

Range: 0~1000

Unit: ms

Used to set the delay time between Servo on and electromagnetic brake interlock.

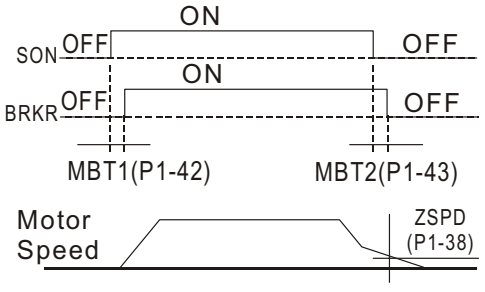
P1 - 43	MBT2	OFF Delay Time of Electromagnetic Brake	Communication Addr.: 012BH

Default: 20 Applicable Control Mode: P/S/T

Range: 0~1000

Unit: ms

Used to set the delay time between Servo off (input power is shut off) and electromagnetic brake interlock.



Note:

1. When MBT2 delay time has not finished and motor speed is lower than the setting value of P1-38, electromagnetic brake interlock signal (BRKR) is closed.
2. When MBT2 delay time has finished and motor speed is still higher than the setting value of P1-38, electromagnetic brake interlock signal (BRKR) is closed.

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P1 - 44▲	GR1	Electronic Gear Ratio (1st Numerator) (N1)	Communication Addr.: 012CH

Default: 1 Applicable Control Mode: P

Range: 1~32767

Unit: Pulse

Multiple-step electronic gear numerator setting. Please refer to P2-60~P2-62.

P1 - 45▲	GR2	Electronic Gear Ratio (Denominator)	Communication Addr.: 012DH

Default: 1 Applicable Control Mode: P

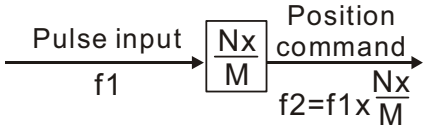
Range: 1~32767

Unit: Pulse

Electronic gear denominator setting.

As the wrong setting can cause motor to run chaotically (out of control) and it may lead to personnel injury, therefore, ensure to observe the following rule when setting P1-44, P1-45.

The electronic gear ratio setting (Please also see P1-44, P2-60~P2-62):



x=1, 2, 3, 4

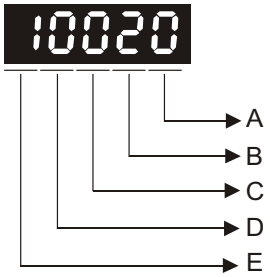
The electronic gear ratio setting range is 1/50<N/M<200.

P1 - 46▲	GR3	PG Dividing Output Pulse Ratio	Communication Addr.: 012EH

Default: 1 Applicable Control Mode: P

Range: 1~125 (when E=0); 10020~12500 (when E=1)

Encoder output pulse number setting



- E=0 : pulse dividing ratio setting. Pulse dividing ratio setting range: 1~125

$$\text{PG dividing output pulses ratio} = \frac{\text{Rotation revolution}}{\text{Setting value}} = 2500/\text{setting value}$$

  For example, if P1-46 is set to 5, the PG dividing output pulses ratio will be equal to 500 (2500/5).

- E=1 : 1-phase pulse number setting of one revolution

  Setting range of (D, C, B, A) value: 20~2500.

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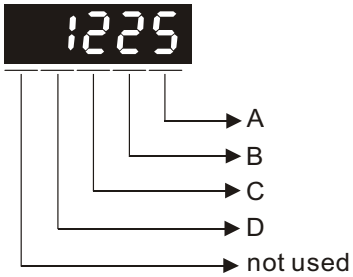
P1 - 47	HMOV	Homing Mode	Communication Addr.: 012FH

Default: 00 Applicable Control Mode: P

Range: 00~1225



D=0: After detecting “Home”, the motor will decelerate and return to “Home”.

D=1: After detecting “Home”, the motor will decelerate and stop in the forward direction.

C=0: Disable homing function.

C=1: Enable homing function automatically after power supplies to the servo drive.

C=2: Enable homing function by SHOM.

B=0: Return to find Z-phase pulse during homing

B=1: Do not return and go forward to find Z-phase pulse during homing

B=2: Positioning at home sensor position or Z-phase pulse during homing (it only can be used when A=2, 3, 4 or 5)

Other: Reserved

A=0: Forward homing (CCWL as “Home”)

A=1: Reverse homing (CWL as “Home”)

A=2: Forward homing (ORGP as “Home”)

A=3: Reverse homing (ORGP as “Home”)

A=4: Forward to find Z-phase pulse and regard Z-phase pulse as “Home”

A=5: Reverse to find Z-phase pulse and regard Z-phase pulse as “Home”

Setting example:

Power supplies to the servo drive, after servo on, immediately perform the homing function and use CCWL as “Home”.

1: Refer to P1-01 for forward and reverse direction

2: CWL and CCWL (refer to Table 7.A) should be assigned into internal input contact (refer to P2-10~P2-17) and connected to external limit switch corresponding to internal contact.

3: Set the value of P1-47 to 100.

4: Restart power on again, after servo on, the drive will immediately perform homing function automatically according to the assigned direction.

Note: When using CWL and CCWL as “Home”, these two inputs will return to limit stop protect function after homing function is completed. It is recommended to set CWL and CCWL at the terminal of equipment to avoid these two inputs may be triggered during normal operation.

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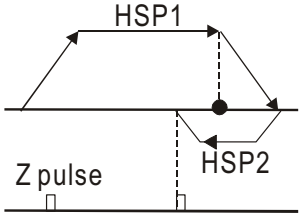
P1 - 48	HSPD1	1st Speed Setting of High Speed Homing	Communication Addr.: 0130H

Default: 1000 Applicable Control Mode: P

Range: 1~2000

Unit: rpm



P1 - 49	HSPD2	2nd Speed Setting of Low Speed Homing	Communication Addr.: 0131H

Default: 50 Applicable Control Mode: P

Range: 1~500

Unit: rpm

P1 - 50	HOF1	Homing Offset Rotation Number	Communication Addr.: 0132H

Default: 0 Applicable Control Mode: P

Range: +/-30000

Unit: rev

P1 - 51	HOF2	Homing Offset Pulse Number	Communication Addr.: 0133H

Default: 0 Applicable Control Mode: P

Range: +/-max. cnt/rev

Unit: pulse

When the value of HOF1, HOF2 (P1-50, P1-51) is set to 0, “Home” will be determined as Z-phase pulse or ORGP according to the setting of P1-47. If the value of HOF1, HOF2 (P1-50, P1-51) is not 0, “Home” will be determined as Z-phase pulse or ORGP plus one offset pulse as new “Home” (HOF1 x 10000 + HOF2).

P1 - 52	RES1	Regenerative Resistor Value	Communication Addr.: 0134H

Range: 10~750 Applicable Control Mode: P/S/T

Unit: ohm

1kW and below	40
1kW and above	20

P1 - 53	RES2	Regenerative Resistor Capacity	Communication Addr.: 0135H

Range: 30~1000 Applicable Control Mode: P/S/T

Unit: Watt

1kW and below	60
1kW and above	120

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P1 - 54	PER	Positioning Completed Width	Communication Addr.: 0136H

Default: 100 Applicable Control Mode: P

Range: 0~10000

Unit: pulse

This parameter is used to band of the target position.

For Example, at factory default TPOS (positioning completed signal) will activate once the motor is in -99 pulses range of the target position, then deactivate after it reaches +99 pulses range of the desired position.

P1 - 55	MSPD	Maximum Speed Limit	Communication Addr.: 0137H

Default: rated speed Applicable Control Mode: P/S/T

Range: 0~max. speed

Unit: rpm

This parameter is used to set maximum rotation speed. The default setting is rated speed.

P1 - 56	OLW	Output Overload Warning	Communication Addr.: 0138H

Default: 50 Applicable Control Mode: P/S/T

Range: 0~100

Unit: %

This parameter is used to set output overload level. When the motor has reached the output overload level set by parameter P1-56, the motor will send a warning to the drive. After the drive has detected the warning, the DI signal OLW will be activated.

t_{OL} = Permissible Time for Overload x the setting value of parameter P1-56

When overload accumulated time (continuously overload time) exceeds the value of tOL, the overload warning signal will output, i.e. DO signal, OLW will be ON. However, if the overload accumulated time (continuously overload time) exceeds the permissible time for overload, the overload alarm (ALE06) will occur.

For example:

If the setting value of parameter P1-56 (Overload Warning Level) is 60%, when the permissible time for overload exceeds 8 seconds at 200% rated output, the overload fault (ALE06) will be detected and shown on the LED display.

At this time, t_{OL} = 8 x 60% = 4.8 seconds

Result:

When the drive output is at 200% rated output and the drive is continuously overloaded for 4.8 seconds, and the overload warning signal will be ON (DO code is 10, i.e. DO signal OLW will be activated). If the drive is continuously overloaded for 8 seconds, the overload alarm will be detected and shown on the LED display (ALE06). Then, Servo Fault signal will be ON (DO signal ALRM will be activated)

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Group 2: P2-xx Extension Parameters

P2 - 00	KPP	Proportional Position Loop Gain	Communication Addr.: 0200H

Default: 35 Applicable Control Mode: P

Range: 0~1023

Unit: rad/s

This parameter is used to set the position loop gain. It can increase stiffness, expedite position loop response and reduce position error. However, if the setting value is over high, it may generate vibration or noise. In easy mode, the value of this parameter is set to the default of the easy mode automatically.

P2 - 01	PPR	Position Gain Switching Rate	Communication Addr.: 0201H

Default: 100 Applicable Control Mode: P

Range: 10~500

Unit: %

This parameter is used to set the position gain switching rate according to gain switching condition.

P2 - 02	PFG	Position Feed Forward Gain	Communication Addr.: 0202H

Default: 5000 Applicable Control Mode: P

Range: 10~20000

Unit: 0.0001

This parameter is used to set the feed forward gain when executing position control command. When using position smooth command, increase gain can improve position track deviation. When not using position smooth command, decrease gain can improve the resonance condition of mechanical system.

P2 - 03	PFF	Smooth Constant of Position Feed Forward Gain	Communication Addr.: 0203H

Default: 5 Applicable Control Mode: P

Range: 2~100

Unit: msec

When using position smooth command, increase gain can improve position track deviation. When not using position smooth command, decrease gain can improve the resonance condition of mechanical system.

P2 - 04	KVP	Proportional Speed Loop Gain	Communication Addr.: 0204H

Default: 500 Applicable Control Mode: P/S

Range: 2~100

Unit: msec

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This parameter is used to set the speed loop gain. When the value of proportional speed loop gain is increased, it can expedite speed loop response. However, if the setting value is over high, it may generate vibration or noise. In easy mode, the value of this parameter is set to the default of the easy mode automatically.

P2 - 05	SPR	Speed 2nd Loop Gain	Communication Addr.: 0205H

Default: 100 Applicable Control Mode: P/S

Range: 10~500

Unit: %

This parameter is used to set the speed 2nd loop gain according to gain switching condition.

P2 - 06	KVI	Speed Integral Compensation	Communication Addr.: 0206H

Default: 100 Applicable Control Mode: P/S

Range: 0~4095

This parameter is used to set the integral time of speed loop. When the value of speed integral compensation is increased, it can improve the speed response ability and decrease the speed control deviation. However, if the setting value is over high, it may generate vibration or noise. In easy mode, the value of this parameter is the default of the easy mode automatically.

P2 - 07	KVF	Speed Feed Forward Gain	Communication Addr.: 0207H

Default: 0 Applicable Control Mode: S

Range: 0~20000

Unit: 0.0001

This parameter is used to set the feed forward gain when executing speed control command.

When using speed smooth command, increase gain can improve speed track deviation.

When not using speed smooth command, decrease gain can improve the resonance condition of mechanical system.

P2 - 08■	PCTL	Password	Communication Addr.: 0208H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~65535

This parameter offers several functions:

1. Users may reset all parameters to their original factory setting.
   Setting:
   10: Users can reset all parameter values to factory defaults. All parameter values will be reset after re-power the servo drive.
2. Users may enable the function of P4-10 and P4-11~P4-21.
   Setting:
   20: If P2-08 is set to 20, then the parameter P4-10 is enabled.
   22: If P2-08 is set to 22, then the parameters P4-11~P4-21 are enabled.

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3. Users may lock the parameters and protect parameters against change by unauthorized personnel.
   - Parameter Lock (Password Input):
     Enter 5-digit password (your password should be at least five characters long). Confirm your password again and then, the password input is completed. (The highest digit of your password number should be at least set to 1).
   - Set parameters:
     Enter correct password, and then you can unlock the parameters and change them.
   - Password Decode
     First, enter correct password, and set P2-08 to 0(zero) twice continuously.

P2 - 09	DRT	Bounce Filter	Communication Addr.: 0209H

Default: 2 Applicable Control Mode: P/S/T

Range: 0~20

Unit: 2 msec

For example, if P2-09 is set to 5, the bounce filter time is 5 x 2ms=10ms.

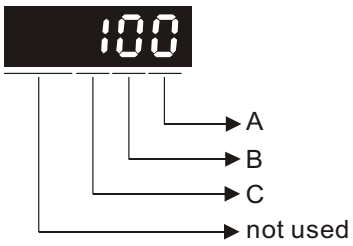
When there are too much vibration or noises around environment, increasing the filter time can improve reliability. However, if the time is too long, it may affect the response time.

P2 - 10	DI1	Digital Input Terminal 1 (DI1)	Communication Addr.: 020AH

Default: 101 Applicable Control Mode: P/S/T

Range: 0~145

Setting:



C=0: normally closed (contact b)

C=1: normally open (contact a)

For the setting value (B, A) of P2-10~P2-17, please refer to Table 7.A.

Please re-start the servo drive after parameters have been changed.

P2 - 11	DI2	Digital Input Terminal 2 (DI2)	Communication Addr.: 020BH

Default: 104 Applicable Control Mode: P/S/T

Range: 0~145

See P2-10 for explanation.

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P2 - 12	DI3	Digital Input Terminal 3 (DI3)	Communication Addr.: 020CH

Default: 116 Applicable Control Mode: P/S/T

Range: 0~145

See P2-10 for explanation.

P2 - 13	DI4	Digital Input Terminal 4 (DI4)	Communication Addr.: 020DH

Default: 117 Applicable Control Mode: P/S/T

Range: 0~145

See P2-10 for explanation.

P2 - 14	DI5	Digital Input Terminal 5 (DI5)	Communication Addr.: 020EH

Default: 102 Applicable Control Mode: P/S/T

Range: 0~145

See P2-10 for explanation.

P2 - 15	DI6	Digital Input Terminal 6 (DI6)	Communication Addr.: 020FH

Default: 22 Applicable Control Mode: P/S/T

Range: 0~145

See P2-10 for explanation.

P2 - 16	DI7	Digital Input Terminal 7 (DI7)	Communication Addr.: 0210H

Default: 23 Applicable Control Mode: P/S/T

Range: 0~145

See P2-10 for explanation.

P2 - 17	DI8	Digital Input Terminal 8 (DI8)	Communication Addr.: 0211H

Default: 21 Applicable Control Mode: P/S/T

Range: 0~145

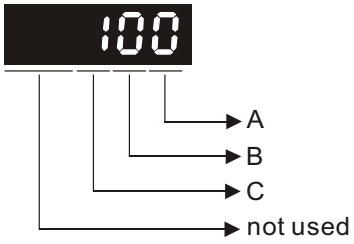
See P2-10 for explanation.

P2 - 18	DO1	Digital Output Terminal 1 (DO1)	Communication Addr.: 0212H

Default: 101 Applicable Control Mode: P/S/T

Range: 0~109

Setting:



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C=0: normally closed (contact b)

C=1: normally open (contact a)

For the setting value (B, A) of P2-18~P2-22, please refer to Table 7.B

Please re-start the servo drive after parameters have been changed.

P2 - 19	DO2	Digital Output Terminal 2 (DO2)	Communication Addr.: 0213H

Default: 103 Applicable Control Mode: P/S/T

Range: 0~109

See P2-18 for explanation.

P2 - 20	DO3	Digital Output Terminal 3 (DO3)	Communication Addr.: 0214H

Default: 109 Applicable Control Mode: P/S/T

Range: 0~109

See P2-18 for explanation.

P2 - 21	DO4	Digital Output Terminal 4 (DO4)	Communication Addr.: 0215H

Default: 105 Applicable Control Mode: P/S/T

Range: 0~109

See P2-18 for explanation.

P2 - 22	DO5	Digital Output Terminal 5 (DO5)	Communication Addr.: 0216H

Default: 7 Applicable Control Mode: P/S/T

Range: 0~109

See P2-18 for explanation.

P2 - 23	NCF	Notch Filter Frequency of Resonance Suppression	Communication Addr.: 0217H

Default: 1000 Applicable Control Mode: P/S/T

Range: 50~1000

Unit: Hz

This parameter is used to set resonance frequency of mechanical system. If P2-24 is set to 0, this parameter is disabled.

P2 - 24	DPH	Notch Filter Attenuation Ratio of Resonance Suppression	Communication Addr.: 0218H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~32

Unit: dB

0: Disabled

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P2 - 25	NLP	Low-pass Filter Time Constant of Resonance Suppression	Communication Addr.: 0219H

Default: 2 (1KW and below models) or
5 (1KW and below above models)
Applicable Control Mode: P/S/T

Range: 0~1000

Unit: msec

This parameter is used to set low-pass filter time constant of resonance suppression.

0: Disabled

P2 - 26	DST	External Anti-Interference Gain	Communication Addr.: 021AH

Default: 0
Applicable Control Mode: P/S/T

Range: 0~30000

Unit: 0.001

In easy mode, the value of this parameter is the default of the easy mode automatically.

0: Disabled

P2 - 27	GCC	Gain Switching Selection	Communication Addr.: 021BH

Default: 0
Applicable Control Mode: P/S

Range: 0~4

Setting:

0: Disabled

1: Gain switching signal (GAINUP) is On.

2: In position control mode, position deviation is higher than the setting value of P2-29.

3: Position command frequency is higher than the setting value of P2-29.

4: Servo motor rotation speed is higher than the setting value of P2-29.

P2 - 28	GUT	Gain Switching Time Constant	Communication Addr.: 021CH

Default: 10
Applicable Control Mode: P/S

Range: 0~1000

Unit: 10 msec

This parameter is used to set the time constant when changing the smooth gain.

0: Disabled

P2 - 29	GPE	Gain Switching Condition	Communication Addr.: 021DH

Default: 10000
Applicable Control Mode: P/S

Range: 0~30000

Unit: Pulse, Kpps, rpm

This parameter is used to set the value of gain switching condition (Pulse error, Kpps, rpm) selected in P2-27.

0: Disabled. The setting value will be different depending on the different gain switching condition.

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P2 - 30■	INH	Auxiliary Function	Communication Addr.: 021EH

Default: 0 Applicable Control Mode: P/S/T

Range: 0~5

Setting:

0: Input contact SON, CW, CCW operate normally.

1: Force to be servo on (ignore CW and CCW signal)

2: Ignore CW limiting signal

3: Ignore CCW limiting signal

4: Internal position learning function

5: After set P2-30 to 5, the setting values of all parameters will lost at power-down.

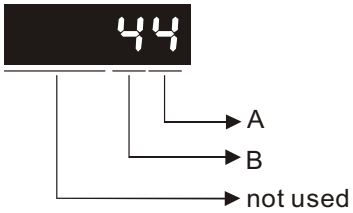
This allows controls to write often to parameters without damaging the EEPROM.

Note: Please set P2-30 to 0 during normal operation. The setting value of P2-30 will return to 0 automatically after re-power the servo drive.

P2 - 31	AUT1	Auto and Easy Mode Selection	Communication Addr.: 021FH

Default: 44 Applicable Control Mode: P/S/T

Range: 0~FF



B: Response setting of auto-tuning mode

The setting value is higher, the response is faster

A: Stiffness setting of easy mode

Adjust the setting value according to the stiffness of the mechanical system.

When the setting value is higher, the control stiffness is also higher.

Note: This parameter is activated by P2-32.

P2 - 32▲	AUT2	Gain Adjustment Method	Communication Addr.: 0220H

Default: 4 Applicable Control Mode: P/S/T

Range: 0~5

Setting:

0: Manual mode

1: Easy mode

2: AutoMode (PI) [Continuous adjustment]

3: AutoMode (PI) [Fix the ratio of Load Inertia to servo motor inertia and response level can be adjusted]

4: AutoMode (PDFF) [Continuous adjust]

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5: AutoMode (PDFF) [Fix the ratio of Load Inertia to servo motor inertia and response level can be adjusted]

PI : Proportional - Integral control

PDFF : Pseudo-Derivative Feedback and Feedforward

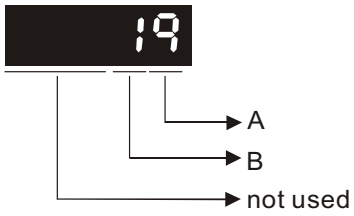
Explanation of Auto-tuning:

1. When switching mode #2 or #4 to #3, the system will save the measured load inertia value automatically and memorized in P1-37. Then, set the corresponding parameters according to this measured load inertia value.
2. When switching mode #2 or #4 to #0, it indicates all automatically measured load inertia value will be aborted, and all setting of parameters will be returned to original setting value in #0 manual mode.
3. When switching mode #0 to #3 or #5, enter the appropriate load inertia value in P1-37.
4. When switching mode #3 to #0, the setting value of P2-00, P2-04 and P2-06 will change to the value that measured in #3 auto-tuning mode.
5. When switching mode #5 to #0, the setting value of P2-00, P2-04, P2-06, P2-25 and P2-26 will change to the value that measured in #5 auto-tuning mode.

P2 - 33▲	INF	Easy Setting of Input Filter	Communication Addr.: 0221H

Default: 00 Applicable Control Mode: P/S/T

Range: 00~19



B=1 Enabled

A=0 Low speed

A=9 High speed

P2 - 34	SDEV	Overspeed Warning Condition	Communication Addr.: 0222H

Default: 5000 Applicable Control Mode: S

Range: 1~5000

Unit: rpm

This parameter is used to set the over speed condition of the drive fault code. (Refer to P0-01)

P2 - 35	PDEV	Excessive Error Warning Condition	Communication Addr.: 0223H

Default: 30000 Applicable Control Mode: P

Range: 1~30000

Unit: pulse

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This parameter is used to set the excessive error condition of the drive fault code (Refer to P0-01). As for the proportion value setting of position excessive error warning condition, please refer to P2-63)

P2 - 36	POV1	Moving Speed Setting of 1st Position	Communication Addr.: 0224H

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

(When setting value of P2-36 to P2-43 is higher than 3000 rpm, please set setting value of P1-55 to its max. value)

P2 - 37	POV2	Moving Speed Setting of 2nd Position	Communication Addr.: 0225H

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

P2 - 38	POV3	Moving Speed Setting of 3rd Position	Communication Addr.: 0226H

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

P2 - 39	POV4	Moving Speed Setting of 4th Position	Communication Addr.: 0227H

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

P2 - 40	POV5	Moving Speed Setting of 5th Position	Communication Addr.: 0228H

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

P2 - 41	POV6	Moving Speed Setting of 6th Position	Communication Addr.: 0229H

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

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P2 - 42	POV7	Moving Speed Setting of 7th Position	Communication Addr.: 022AH

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

P2 - 43	POV8	Moving Speed Setting of 8th Position	Communication Addr.: 022BH

Default: 1000 Applicable Control Mode: P

Range: 1~5000

Unit: rpm

P2 - 44	DOM	Digital Output Mode Setting	Communication Addr.: 022CH

Default: 0 Applicable Control Mode: P

Range: 0~1

0: General output mode (DO is outputted according to the setting value of P2-18~P2-22)

1: Combination output mode

This output mode must be select and set when users want to use feed step control function. Otherwise, the feed step control function can not be used normally.

P2 - 45	DOD	Combination Output Signal Delay Time	Communication Addr.: 022DH

Default: 1 Applicable Control Mode: P

Range: 0~250

Unit: 4msec

Output signal holding delay time when positioning is completed.

P2 - 46	FSN	Feed Step Number	Communication Addr.: 022EH

Default: 6 Applicable Control Mode: P

Range: 2~32

P2 - 47	PED	Position Deviation Clear Delay Time	Communication Addr.: 022FH

Default: 0 Applicable Control Mode: P

Range: 0~250

Unit: 20msec

This function is disabled when its setting value is set to 0.

P2 - 48	BLAS	Backlash Compensation of Feed Step Control	Communication Addr.: 0230H

Default: 0 Applicable Control Mode: P

Range: 0~10312

Unit: pulse

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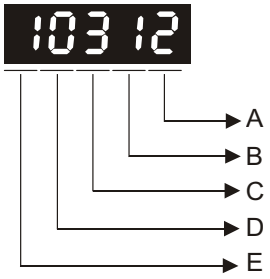


Value (C, B, A): 0~312, the pulse number of backlash compensation

Actual pulse number of backlash compensation of motor output shaft is equal to the number of value (C, B, A) x electronic gear ratio

E=0: Forward compensation

E=1: Reverse compensation

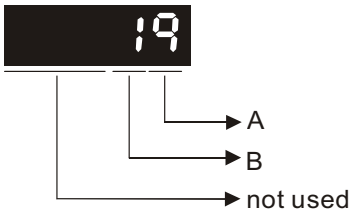
Note: After modifying the setting value, execute the home sensor function. After executing the home sensor function, perform the control function.

P2 - 49	SJIT	Speed Detection Filter and Jitter Suppression	Communication Addr.: 0231H

Default: 0 Applicable Control Mode: P/S

Range: 0~19

Unit: sec



B=1 : Activate jitter suppression function at stall

A= 0~9 : Set speed estimator response

P2 - 50	CCLR	Pulse Clear Mode	Communication Addr.: 0232H

Default: 0 Applicable Control Mode: P

Range: 0~2

For input function, please refer to Table 7.A.

When the servo drive is set to CCLR mode, the pulse clear function is enabled.

0: Clear position pulse deviation number (available in Pt and Pr mode)

When input terminal is connected, the position accumulated pulse number will be clear to 0.

1: Clear motor feedback pulse number (available in Pt and Pr mode)

When input terminal is connected, the count pulse number will be clear to 0. This point is regarded as the “Home” (zero point) of the motor.

2 Clear the residual pulse and interrupt the motor operation (available Pr mode)

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P2 - 51	SRON	Servo ON	Communication Addr.: 0233H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~1

0: Servo ON (SON) is activated via Digital Input signal

1: Servo ON (SON) is activated when control power is applied the servo drive (not via Digital Input signal)

Servo ON (SON) is "ON" with control power applied to the servo drive, there may be a fault condition or not. The servo is not ready to run.

Servo ready (SRDY) is "ON" where the servo is ready to run, NO fault / alarm exists. (P2-51 should turn servo ready SRDY off / on)

P2 - 52	ATM0	Timer 0 of Auto Mode	Communication Addr.: 0234H

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

P2 - 53	ATM1	Timer 1 of Auto Mode	Communication Addr.: 0235H

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

P2 – 54	ATM2	Timer 2 of Auto Mode	Communication Addr.: 0236H

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

P2 - 55	ATM3	Timer 3 of Auto Mode	Communication Addr.: 0237H

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

P2 – 56	ATM4	Timer 4 of Auto Mode	Communication Addr.: 0238H

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

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P2 - 57	ATM5	Timer 5 of Auto Mode	Communication Addr.: 0239H

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

P2 – 58	ATM6	Timer 6 of Auto Mode	Communication Addr.: 023AH

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

P2 - 59	ATM7	Timer 7 of Auto Mode	Communication Addr.: 023BH

Default: 0 Applicable Control Mode: P

Range: 0~120.00

Unit: sec

P2 - 60	GR4	Electronic Gear Ratio (2nd Numerator) (N2)	Communication Addr.: 023CH

Default: 1 Applicable Control Mode: P

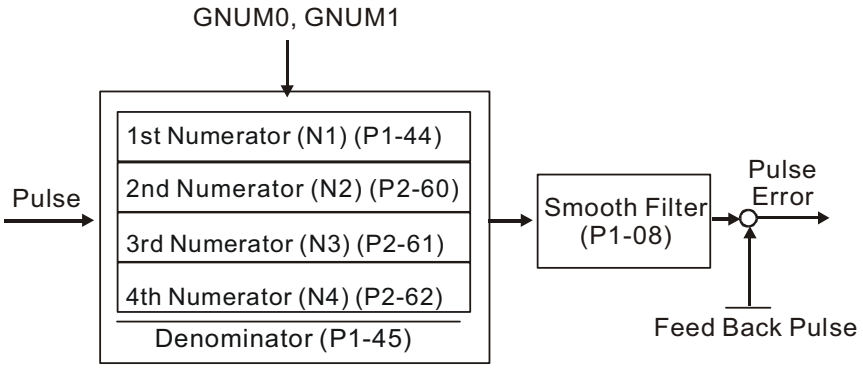
Range: 1~32767

Unit: Pulse

The electronic gear numerator value can be set via GNUM0, GNUM1 (refer to Table 7.A).

When the GNUM0, GNUM1 are not defined, the default of gear numerator value is set by P1-44.

When users wish to set the gear numerator value by using GNUM0, GNUM1, please set P2-60~ P2-62 after the servo motor has been stopped.



P2 - 61	GR5	Electronic Gear Ratio (3rd Numerator) (N3)	Communication Addr.: 023DH

Default: 1 Applicable Control Mode: P

Range: 1~32767

Unit: Pulse

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P2 - 62	GR6	Electronic Gear Ratio (4th Numerator) (N4)	Communication Addr.: 023EH

Default: 1 Applicable Control Mode: P

Range: 1~32767

Unit: Pulse

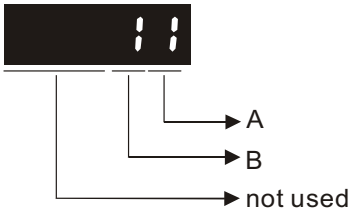
P2 - 63	TSCA	Proportion Value Setting	Communication Addr.: 023FH

Default: 0 Applicable Control Mode: P/S

Range: 0~11

Unit: times

Setting:



Value A: decimal place setting of internal speed command.

0: When value A is set to 0, the unit of P1-09~P1-11 is 1 rpm (No decimal place setting)

1: When value A is set to 1, the unit of P1-09~P1-11 is 0.1rpm (One decimal place setting)

If P1-09 is set to 1234, and value A is set to 0, and then the internal speed is 1234rpm.

If P1-09 is set to 1234, and value A is set to 1, and then the internal speed is 123.4rpm.

This value A setting is available for internal speed command only, not available for speed limit command.

Value B: Proportion value setting of position excessive error warning condition (P2-35)

0: When value B is set to 0, the unit of P2-35 is 1 pulse

1: When value B is set to 1, the unit of P2-35 is 100 pulses

If P2-35 is set to 1000, and value B is set to 0, the position excessive error warning pulse is 1000 pulses.

If P2-35 is set to 1000, and value B is set to 1, the position excessive error warning pulse is 100,000 pulses.

P2 - 64	TLMOD	Torque Limit Mixed Mode	Communication Addr.: 0240H

Default: 0 Applicable Control Mode: P/S

Range: 0~3

This parameter can allow users to set two different kinds of torque limit command sources when limiting torque. We call it is “Torque Limit Mixed Mode”.

The torque limit function is activated by parameter P1-02 or via digital input TRQLM, TLLM or TRLM.

If users use TRQLM or P1-02 to activate torque limit function, the torque limit command source can be analog input or internal parameters (P1-12 to P1-14) depending on which way you use to activate torque limit function. At this time, the limit of PL and NL in the figure below are specified

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as the torque limit that determined by the torque limit command source.

If users use TLLM or TRLM to activate torque limit function, the torque limit command source can be parameter P1-12 (NL) or P1-13 (PL).

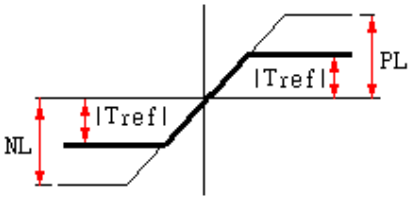
PL: Positive Limit

NL: Negative Limit

Tref: Torque Analog Input Voltage

Tpl: Actual PL value in “Torque Limit Mixed Mode”

Tnl: Actual NL value in “Torque Limit Mixed Mode”



Setting:

0: Disabled

1: Torque limit mixed mode (No polarity)

If |Tref|<PL, Tpl = |Tref|

If |Tref|>PL, Tpl = PL

If |Tref|<NL, Tnl = |Tref|

If |Tref|>NL, Tnl = NL

2: Torque limit mixed mode (Positive)

If 0<Tref<PL, Tpl = Tref

If Tref>PL, Tpl = PL

If Tref<0, Tpl,Tnl = 0

3: Torque limit mixed mode (Negative)

If Tref>0, Tpl,Tnl = 0

If -NL<Tref<0, NL = -Tref

If Tref<-NL, NL = NL

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Group 3: P3-xx Communication Parameters

P3 - 00	ADR	Communication Address	Communication Addr.: 0300H

Default: 1 Applicable Control Mode: P/S/T

Range: 0~254

If the AC servo drive is controlled by RS-232/485/422 communication, each drive (or device) must be uniquely identified and addressed between 1 and 254. Access to program this number is via parameter P3-00.

One servo drive only can set one communication address. If the communication address is duplicate, there will be a communication fault. If the communication address is set to 0, it is with broadcast function.

P3 - 01	BRT	Transmission Speed	Communication Addr.: 0301H

Default: 1 Applicable Control Mode: P/S/T

Range: 0~5

Unit: bps

Setting:

0: Baud rate 4800 (data transmission speed: bits / second)

1: Baud rate 9600 (data transmission speed: bits / second)

2: Baud rate 19200 (data transmission speed: bits / second)

3: Baud rate 38400 (data transmission speed: bits / second)

4: Baud rate 57600 (data transmission speed: bits / second)

5: Baud rate 115200 (data transmission speed: bits / second)

This parameter is used to set the desired transmission speed between the computer and AC servo drive. Users can set this parameter and control transmission speed to reach the maximum baud rate of 115200 bps.

P3 - 02	PTL	Communication Protocol	Communication Addr.: 0302H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~8

Setting:

0: Modbus ASCII mode, <7,N,2>

1: Modbus ASCII mode, <7,E,1 >

2: Modbus ASCII mode, <7,O,1>

3: Modbus ASCII mode, <8,N,2 >

4: Modbus ASCII mode, <8,E,1>

5: Modbus ASCII mode, <8,O,1>

6: Modbus RTU mode, <8,N,2>

7: Modbus RTU mode, <8,E,1>

8: Modbus RTU mode, <8,O,1>

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This parameter is used to set the communication protocol. The alphanumeric characters represent the following: 7 or 8 is the number of data bits; N, E or O refer to the parity bit, Non, Even or Odd; the 1 or 2 is the numbers of stop bits.

P3 - 03	FLT	Transmission Fault Treatment	Communication Addr.: 0303H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~1

Setting:

0: Display fault and continue operating

1: Display fault and stop operating

This parameter is used to determine the operating sequence once a communication fault has been detected. If '1' is selected the drive will stop operating upon detection the communication fault. The mode of stopping is set by parameter P1-32.

P3 - 04	CWD	Communication Time Out Detection	Communication Addr.: 0304H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~20

Setting:

0: Disabled

When this parameter is set to a value over than 0, it indicates this function is enabled.

P3 - 05	CMM	Communication Selection	Communication Addr.: 0305H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~2

Setting:

0: RS-232

1: RS-422

2: RS-485

Multiple communication modes RS232, RS-485, RS-422 cannot be used within one communication ring.

P3 - 06■	SDI	Digital Input Contact Control	Communication Addr.: 0306H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~FFFF

The setting of this parameter determines how the Digital Inputs (DI) accept commands and signals.

Setting:

If the Digital Input Contact Control parameter for the DI 1 ~ 8 is set to "0", command is external, and via CN1; if it is set to "1" the DI signal is via communication.

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The Digital Input Control Contact parameter, P3-06 also works in conjunction with the Multi Function Digital Input parameter P4-07 which has several functions. Please see page 8-6 for details.

P3 - 07	CDT	Communication Response Delay Time	Communication Addr.: 0307H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~255

Unit: 0.5msec

Used to delay the communication time that servo drive respond to host controller (external controller)

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Group 4: P4-xx Diagnosis Parameters

P4 - 00★	ASH1	Fault Record (N)	Communication Addr.: 0400H

Default: 0 Applicable Control Mode: P/S/T

The latest fault record.

P4 - 01★	ASH2	Fault Record (N-1)	Communication Addr.: 0401H

Default: 0 Applicable Control Mode: P/S/T

P4 - 02★	ASH3	Fault Record (N-2)	Communication Addr.: 0402H

Default: 0 Applicable Control Mode: P/S/T

P4 - 03★	ASH4	Fault Record (N-3)	Communication Addr.: 0403H

Default: 0 Applicable Control Mode: P/S/T

P4 - 04★	ASH5	Fault Record (N-4)	Communication Addr.: 0404H

Default: 0 Applicable Control Mode: P/S/T

P4 - 05	JOG	JOG Operation	Communication Addr.: 0405H

Default: 20 Applicable Control Mode: P/S/T

Range: 1~5000

Unit: rpm

JOG operation command:

1. Operation Test
   (1) Press the SET key to display the JOG rpm speed. (The default value is 20 rpm).
   (2) Press the UP or DOWN arrow keys to increase or decrease the desired JOG speed. (This also can be undertaken by using the SHIFT key to move the cursor to the desired unit column (the effected number will flash) then changed using the UP and DOWN arrow keys).
   (3) Press the SET when the desired JOG speed is displayed. The Servo Drive will display "JOG"
   (4) Press the UP or DOWN arrow keys to jog the motor either CCW or CW. The motor will only rotation while the arrow key is activated.
   (5) To change JOG speed again, press the MODE key. The servo Drive will display "P4 - 05". Press the SET key and the JOG rpm speed will displayed again. Refer back to #(2) and #(3) to change speed.

If there is any error display in this mode, the JOG operation will stop. The max. JOG speed is the rated speed of servo motor.

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2. DI Signal Control

   Set the value of DI signal as JOGU and JOGD (refer to Table 7.A).

   Users can perform JOG run forward and run reverse control.

3. Communication Control

   To perform a JOG Operation via communication command, use communication address 0405H

   (1) Enter 0 ~ 3000 for the desired JOG rpm

   (2) Enter 4998 to JOG in the CCW direction

   (3) Enter 4999 to JOG in the CW direction

   (4) Enter 5000 to stop the JOG operation

(Note: If the communication write-in frequency is too high, please set P2-30 to 5)

P4 - 06▲	FOT	Force Output	Communication Addr.: 0406H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~0x1F

0: Disabled

(When the value of communication control parameter is set to 0, it can disable the force output function.)

P4 - 07	ITST	Multi Function Digital Input	Communication Addr.: 0407H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~FFFF

See P3-06 for setting method.

External Control: Display the status of DI input signal

Communication Control: Read the status of input signal (upon software)

P4 - 08	PKEY	Digital Keypad Input of Servo Drive	Communication Addr.: 0408H

Applicable Control Mode: P/S/T

P4 - 09	MOT	Multi Function Digital Output	Communication Addr.: 0409H

Default: 0 Applicable Control Mode: P/S/T

Range: 0~0x1F

External Control: Display the status of DO output signal

Communication Control: Read the status of output signal

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P4 - 10▲	CEN	Adjustment Function	Communication Addr.: 040AH

Default: 0 Applicable Control Mode: P/S/T

Range: 0~6

Setting:

0: Reserved

1: Execute analog speed input offset adjustment

2: Execute analog torque input offset adjustment

3: Execute current detector (V phase) offset adjustment

4: Execute current detector (W phase) offset adjustment

5: Execute offset adjustment of the above 1~4

6: Execute IGBT ADC adjustment

Note: This adjustment function is enabled after parameter P2-08 is set. When execute any adjustment, the external wiring connected to analog speed or torque must be removed and the servo system should be off (Servo off).

P4 - 11	SOF1	Analog Speed Input Offset 1	Communication Addr.: 040BH

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

This parameter is enabled after parameter P2-08 is set. This is an auxiliary adjusting function, it is not recommended to change the default setting manually. This parameter cannot be reset.

P4 - 12	SOF2	Analog Speed Input Offset 2	Communication Addr.: 040CH

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

See P4-11 for explanation.

P4 - 13	TOF1	Analog Torque Input Offset 1	Communication Addr.: 040DH

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

See P4-11 for explanation.

P4 - 14	TOF2	Analog Torque Input Offset 2	Communication Addr.: 040EH

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

See P4-11 for explanation.

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P4 - 15	COF1	Current Detector Offset (V1 phase)	Communication Addr.: 040FH

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

See P4-11 for explanation.

P4 - 16	COF2	Current Detector Offset (V2 phase)	Communication Addr.: 0410H

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

See P4-11 for explanation.

P4 - 17	COF3	Current Detector Offset (W1 phase)	Communication Addr.: 0411H

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

See P4-11 for explanation.

P4 - 18	COF4	Current Detector Offset (V2 phase)	Communication Addr.: 0412H

Default: Factory setting Applicable Control Mode: P/S/T

Range: 0~32767

See P4-11 for explanation.

P4 - 19	TIGB	Adjustment Level of IGBT NTC	Communication Addr.: 0413H

Default: Factory setting Applicable Control Mode: P/S/T

Range: 1~7

This parameter cannot be reset.

Please cool the servo drive to 25°C when performing this function..

P4 - 20	DOF1	Offset Adjustment Value of Analog Monitor Output (CH1)	Communication Addr.: 0414H

Default: 0 Applicable Control Mode: P/S/T

Range: -800~800

Unit: mV

This parameter cannot be reset.

P4 - 21	DOF2	Offset Adjustment Value of Analog Monitor Output (CH2)	Communication Addr.: 0415H

Default: 0 Applicable Control Mode: P/S/T

Range: -800~800

Unit: mV

This parameter cannot be reset.

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P4 - 22	SAO	Analog Speed Input Offset (Firmware)	Communication Addr.: 0416H

Default: 0 Applicable Control Mode: S

Range: -5000~5000

Unit: mV

Users manually adjust offset value

P4 - 23	TAO	Analog Torque Input Offset (Firmware)	Communication Addr.: 0417H

Default: 0 Applicable Control Mode: T

Range: -5000~5000

Unit: mV

Users manually adjust offset value

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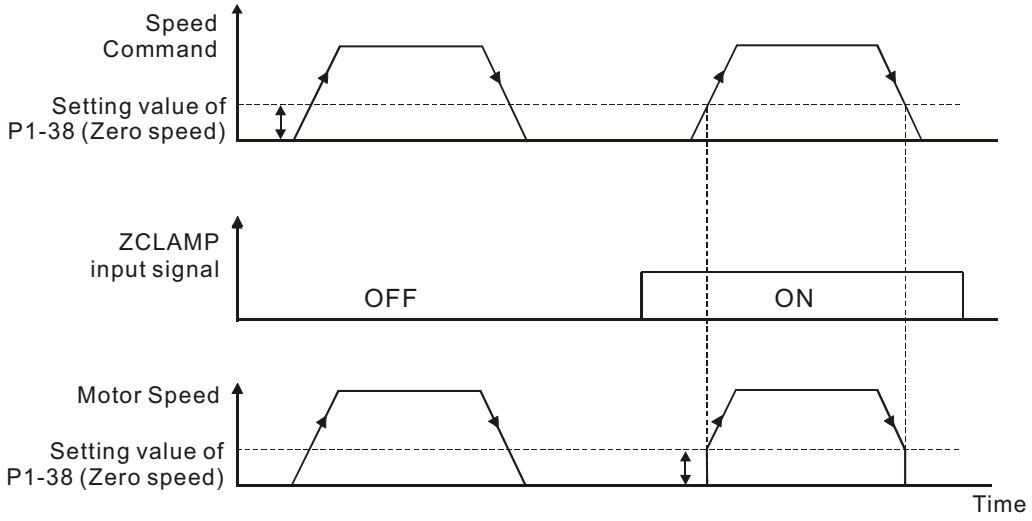
Table 7.A Input Function Definition

Sign	Setting Value	DI Function Description
SON	01	Servo On. Switch servo to "Servo Ready". Check parameter P2-51.
ARST	02	Reset. A number of Faults (Alarms) can be cleared by activating ARST.
GAINUP	03	Gain switching in speed and position mode. When GAINUP is activated (P2-27 is set to 1), the gain is switched to the gain multiplied by fluctuation
CCLR	04	Pulse clear (see P2-50). When CCLR is activated the setting is parameter P2-50 Pulse Clear Mode is executed. 0: Clear position pulse deviation number (available in Pt and Pr mode) When input terminal is connected, the position accumulated pulse number will be clear to 0. 1: Clear motor feedback pulse number (available in Pt and Pr mode) When input terminal is connected, the count pulse number will be clear to 0. This point is regarded as the “Home” (zero point) of the motor. 2 Clear the residual pulse and interrupt the motor operation (available Pr mode)
ZCLAMP	05	Low speed CLAMP. When this signal is On and the motor speed value is below the setting value of P1-38, it is used to lock the motor in the instant position while ZCLAMP is On. 
CMDINV	06	Command input reverse control. When the drive is in Pr, Speed and Torque mode, and CMDINV is activated, the motor is in reverse rotation.
HOLD	07	Internal position control command pause. When the drive is in Pr mode and HOLD is activated, the motor will pause.
CTRG	08	Command triggered. When the drive is in Pr mode and CTRG is activated, the drive will command the motor to move the stored position which correspond the POS 0, POS 1, POS 2 settings. Activation is triggered on the rising edge of the pulse.
TRQLM	09	Torque limit enabled. When the drive is in speed and position mode, and TRQLM is activated, it indicates the torque limit command is valid. The torque limit command source is internal parameter or analog voltage.
SPDLM	10	Speed limit enabled. When the drive is in torque mode and TRQLM is activated, it indicates the speed limit command is valid. The speed limit command source is internal parameter or analog voltage.

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<table>
<tr><th>Sign</th><th>Setting Value</th><th>DI Function Description</th></tr>
<tr><td>POS0</td><td>11</td><td rowspan="3">Position command selection (1~8)
When the Pr mode is selected, the 8 stored positions are programmed via a combination of the POS 0, POS 1, and POS 2 commands.
<table>
<tr><th>Command No.</th><th>POS2</th><th>POS1</th><th>POS0</th><th>CTRG</th><th>Parameter</th></tr>
<tr><td rowspan="2">P1</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">↑</td><td>P1-15</td></tr><tr><td>P1-16</td></tr>
<tr><td rowspan="2">P2</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">ON</td><td rowspan="2">↑</td><td>P1-17</td></tr><tr><td>P1-18</td></tr>
<tr><td rowspan="2">P3</td><td rowspan="2">OFF</td><td rowspan="2">ON</td><td rowspan="2">OFF</td><td rowspan="2">↑</td><td>P1-19</td></tr><tr><td>P1-20</td></tr>
<tr><td rowspan="2">P4</td><td rowspan="2">OFF</td><td rowspan="2">ON</td><td rowspan="2">ON</td><td rowspan="2">↑</td><td>P1-21</td></tr><tr><td>P1-22</td></tr>
<tr><td rowspan="2">P5</td><td rowspan="2">ON</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">↑</td><td>P1-23</td></tr><tr><td>P1-24</td></tr>
<tr><td rowspan="2">P6</td><td rowspan="2">ON</td><td rowspan="2">OFF</td><td rowspan="2">ON</td><td rowspan="2">↑</td><td>P1-25</td></tr><tr><td>P1-26</td></tr>
<tr><td rowspan="2">P7</td><td rowspan="2">ON</td><td rowspan="2">ON</td><td rowspan="2">OFF</td><td rowspan="2">↑</td><td>P1-27</td></tr><tr><td>P1-28</td></tr>
<tr><td rowspan="2">P8</td><td rowspan="2">ON</td><td rowspan="2">ON</td><td rowspan="2">ON</td><td rowspan="2">↑</td><td>P1-29</td></tr><tr><td>P1-30</td></tr>
</table></td></tr>
<tr><td>POS1</td><td>12</td></tr>
<tr><td>POS2</td><td>13</td></tr>
<tr><td>SPD0</td><td>14</td><td rowspan="2">Speed command selection (1~4)
<table>
<tr><th rowspan="2">Command No.</th><th colspan="2">DI signal of CN1</th><th colspan="3" rowspan="2">Command Source</th><th rowspan="2">Content</th><th rowspan="2">Range</th></tr>
<tr><th>SPD1</th><th>SPD0</th></tr>
<tr><td rowspan="2">S1</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">Mode</td><td>S</td><td>External analog command</td><td>Voltage between V-REF and GND</td><td>+/-10 V</td></tr>
<tr><td>Sz</td><td>None</td><td>Speed command is 0</td><td>0</td></tr>
<tr><td>S2</td><td>OFF</td><td>ON</td><td colspan="3" rowspan="3">Internal parameter</td><td>P1-09</td><td>0~5000 rpm</td></tr>
<tr><td>S3</td><td>ON</td><td>OFF</td><td>P1-10</td><td>0~5000 rpm</td></tr>
<tr><td>S4</td><td>ON</td><td>ON</td><td>P1-11</td><td>0~5000 rpm</td></tr>
</table></td></tr>
<tr><td>SPD1</td><td>15</td></tr>
<tr><td>TCM0</td><td>16</td><td rowspan="2">Torque command selection (1~4)
<table>
<tr><th rowspan="2">Command No.</th><th colspan="2">DI signal of CN1</th><th colspan="3" rowspan="2">Command Source</th><th rowspan="2">Content</th><th rowspan="2">Range</th></tr>
<tr><th>TCM1</th><th>TCM0</th></tr>
<tr><td rowspan="2">T1</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td rowspan="2">Mode</td><td>T</td><td>Analog command</td><td>Voltage between V-REF and GND</td><td>+/-10 V</td></tr>
<tr><td>Tz</td><td>None</td><td>Torque command is 0</td><td>0</td></tr>
<tr><td>T2</td><td>OFF</td><td>ON</td><td colspan="3" rowspan="3">Internal parameter</td><td>P1-12</td><td>0 ~ 300 %</td></tr>
<tr><td>T3</td><td>ON</td><td>OFF</td><td>P1-13</td><td>0 ~ 300 %</td></tr>
<tr><td>T4</td><td>ON</td><td>ON</td><td>P1-14</td><td>0 ~ 300 %</td></tr>
</table></td></tr>
<tr><td>TCM1</td><td>17</td></tr>
<tr><td>S-P</td><td>18</td><td>Speed / Position mode switching OFF: Speed, ON: Position</td></tr>
</table>

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<table>
<tr><th>Sign</th><th>Setting Value</th><th colspan="2">DI Function Description</th></tr>
<tr><td>S-T</td><td>19</td><td colspan="2">Speed / Torque mode switching OFF: Speed, ON: Torque</td></tr>
<tr><td>T-P</td><td>20</td><td colspan="2">Torque / Position mode switching OFF: Torque, ON: Position</td></tr>
<tr><td>EMGS</td><td>21</td><td colspan="2">Emergency stop. It should be contact “b” and normally ON or a fault (ALE13) will display.</td></tr>
<tr><td>CWL</td><td>22</td><td colspan="2">Reverse inhibit limit. It should be contact “b” and normally ON or a fault (ALE14) will display.</td></tr>
<tr><td>CCWL</td><td>23</td><td colspan="2">Forward inhibit limit. It should be contact “b” and normally ON or a fault (ALE15) will display.</td></tr>
<tr><td>ORGP</td><td>24</td><td colspan="2">Reference “Home” sensor. When ORGP is activated, the drive will command the motor to start to search the reference “Home” sensor. [see P1-47]</td></tr>
<tr><td>TLLM</td><td>25</td><td colspan="2">Reverse operation torque limit (Torque limit function is valid only when P1-02 is enabled)</td></tr>
<tr><td>TRLM</td><td>26</td><td colspan="2">Forward operation torque limit (Torque limit function is valid only when P1-02 is enabled)</td></tr>
<tr><td>SHOM</td><td>27</td><td colspan="2">Move to “Home”. When SHOM is activated, the drive will command the motor to move to “Home”. [see P1-47]</td></tr>
<tr><td>INDEX0</td><td>28</td><td>Feed step selection input 0 (bit 0)</td><td rowspan="5">When the drive is in Pr mode, if users set P1-33 to 2, 3 and 4 (Feed step control mode), feed step control function are provided (1~32 steps). [see section 12-6 Feed Step Control]</td></tr>
<tr><td>INDEX1</td><td>29</td><td>Feed step selection input 1 (bit 1)</td></tr>
<tr><td>INDEX2</td><td>30</td><td>Feed step selection input 2 (bit 2)</td></tr>
<tr><td>INDEX3</td><td>31</td><td>Feed step selection input 3 (bit 3)</td></tr>
<tr><td>INDEX4</td><td>32</td><td>Feed step selection input 4 (bit 4)</td></tr>
<tr><td>MD0</td><td>33</td><td>Feed step mode input 0 (bit 0)</td><td rowspan="4">Mode function:
<table>
<tr><th>MDPn</th><th>Status</th><th>MD1</th><th>MD0</th><th>Explanation</th></tr>
<tr><td rowspan="4">OFF</td><td>1</td><td>OFF</td><td>OFF</td><td>Torque decrease</td></tr>
<tr><td>2</td><td>OFF</td><td>ON</td><td>Feed step position mode</td></tr>
<tr><td>3</td><td>ON</td><td>OFF</td><td>Homing mode</td></tr>
<tr><td>4</td><td>ON</td><td>ON</td><td>Emergency stop</td></tr>
<tr><td rowspan="4">ON</td><td></td><td>X</td><td>X</td><td>Don’t care</td></tr>
<tr><td></td><td>OFF</td><td>ON</td><td>CW manual operation</td></tr>
<tr><td></td><td>ON</td><td>OFF</td><td>CCW manual operation</td></tr>
<tr><td></td><td>X</td><td>X</td><td>Don’t care</td></tr>
</table></td></tr>
<tr><td>MD1</td><td>34</td><td>Feed step mode input 1 (bit 1)</td></tr>
<tr><td>MDP0</td><td>35</td><td>Manually continuous operation</td></tr>
<tr><td>MDP1</td><td>36</td><td>Manually single step operation</td></tr>
<tr><td>JOGU</td><td>37</td><td colspan="2">Forward JOG input. When JOGU is activated, the motor will JOG in forward direction. [see P4-05]</td></tr>
<tr><td>JOGD</td><td>38</td><td colspan="2">Reverse JOG input. When JOGD is activated, the motor will JOG in reverse direction. [see P4-05]</td></tr>
<tr><td>STEPU</td><td>39</td><td>Step up input. When STEPU is activated, the motor will run to next position.</td><td>Available when the drive is in Pr mode and users must set P1-33 to 5 and 6. (Internal auto running mode) [see section 12-7 Internal Auto Running Mode]</td></tr>
</table>

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Sign	Setting Value	DI Function Description	
STEPD	40	Step down input. When STEPD is activated, the motor will run to previous position.	Available when the drive is in Pr mode and users must set P1-33 to 5 and 6. (Internal auto running mode) [see section 12-7 Internal Auto Running Mode]
STEPB	41	Step back input. When STEPB is activated, the motor will return to first position.	
AUTOR	42	Auto run input. When AUTOR is activated, the motor will run automatically according to internal position command. For time interval setting, please see P2-52 to P2-59.	
GNUM0	43	Electronic gear ratio (Numerator) selection 0 [see P2-60~P2-62]	
GNUM1	44	Electronic gear ratio (Numerator) selection 1 [see P2-60~P2-62]	
INHP	45	Pulse inhibit input. When the drive is in position mode, if INHP is activated, the external pulse input command is not valid.	

Note:

1. 11~17: Single control mode, 18~20: Dual control mode
2. When P2-10 to P2-17 is set to 0, it indicates input function is disabled.

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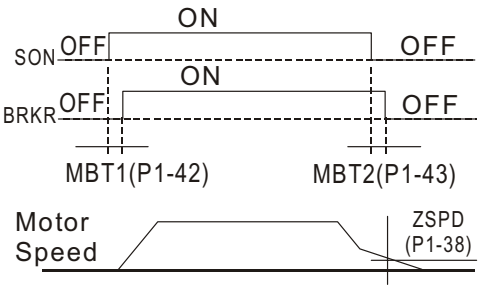
Table 7.B Output Function Definition

Sign	Setting Value	DO Function Description
SRDY	01	Servo ready. SRDY is activated when the servo drive is ready to run. All fault and alarm conditions, if present, have been cleared.
SON	02	Servo On. SON is activated when control power is applied the servo drive. The drive may or may not be ready to run as a fault / alarm condition may exist.Servo ON (SON) is "ON" with control power applied to the servo drive, there may be a fault condition or not. The servo is not ready to run. Servo ready (SRDY) is "ON" where the servo is ready to run, NO fault / alarm exists. (P2-51 should turn servo ready SRDY off / on)
ZSPD	03	Zero speed. ZSPD is activated when the drive senses the motor is equal to or below the Zero Speed Range setting as defined in parameter P1-38. For Example, at default ZSPD will be activated when the drive detects the motor rotating at speed at or below 10 rpm. ZSPD will remain activated until the motor speed increases above 10 RPM.
TSPD	04	Speed reached. TSPD is activated once the drive has detected the motor has reached the Target Rotation Speed setting as defined in parameter P1-39. TSPD will remain activated until the motor speed drops below the Target Rotation Speed.
TPOS	05	Positioning completed. 1. When the drive is in Pt mode, TPOS will be activated when the position error is equal and below the setting value of P1-54. 2. When the drive is in Pr mode, TPOS will be activated when the drive detects that the position of the motor is in a -P1-54 to +P1-54 band of the target position. For Example, at factory default TPOS will activate once the motor is in -99 pulses range of the target position, then deactivate after it reaches +99 pulses range of the desired position.
TQL	06	Reached torques limits. TQL is activated when the drive has detected that the motor has reached the torques limits set by either the parameters P1-12 ~ P1-14 of via an external analog voltage.
ALRM	07	Servo alarm output (Servo fault). ALRM is activated when the drive has detected a fault condition.
BRKR	08	Electromagnetic brake. BRKR is activated actuation of motor brake. (Please refer to parameters P1-42 ~ P1-43) 
HOME	09	Home completed. HOME is activated when the servo drive has detected that the "HOME" sensor (Digital Input 24) has been detected and the home conditions set in parameters P1-47, P1-50, and P1-51 have been satisfied.
OLW	10	Output overload warning. OLW is activated when the servo drive has detected that the motor has reached the output overload level set by parameter P1-56.

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🕮 **Note:** When P2-18 to P2-22 is set to 0, it indicates input function is disabled.

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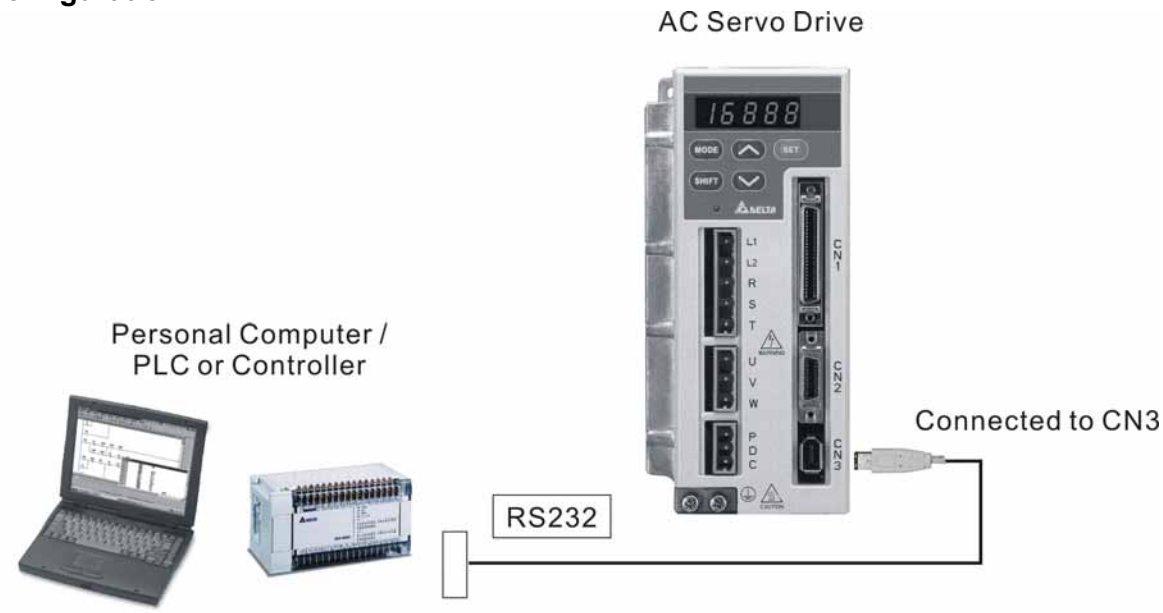
Chapter 8 MODBUS Communications

8-1 Communication Hardware Interface

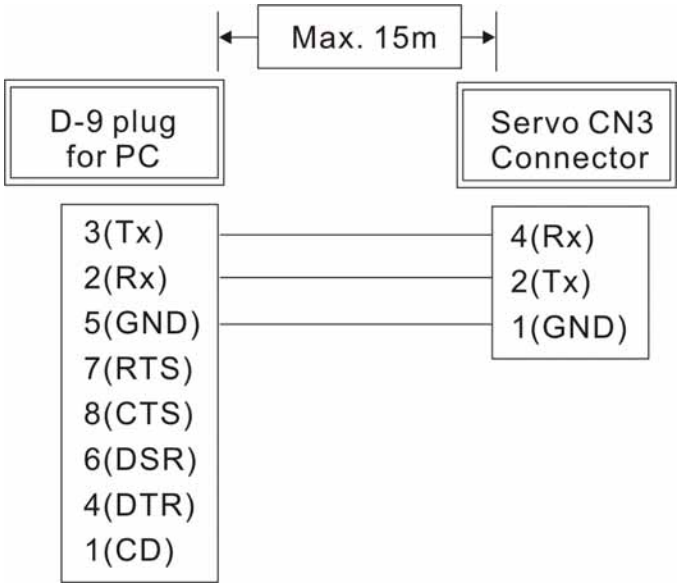
The ASDA-A series servo controller has three modes of communication: RS-232, RS-485, and RS-422. All aspects of control, operation and monitoring as well as programming of the controller can be achieved via communication. However, only one communication mode can be used at a time. Users can select the desired communication mode via parameter P3-05. Please refer to the following sections for connections and limitations.

RS-232

■ **Configuration**



■ **Cable Connection**



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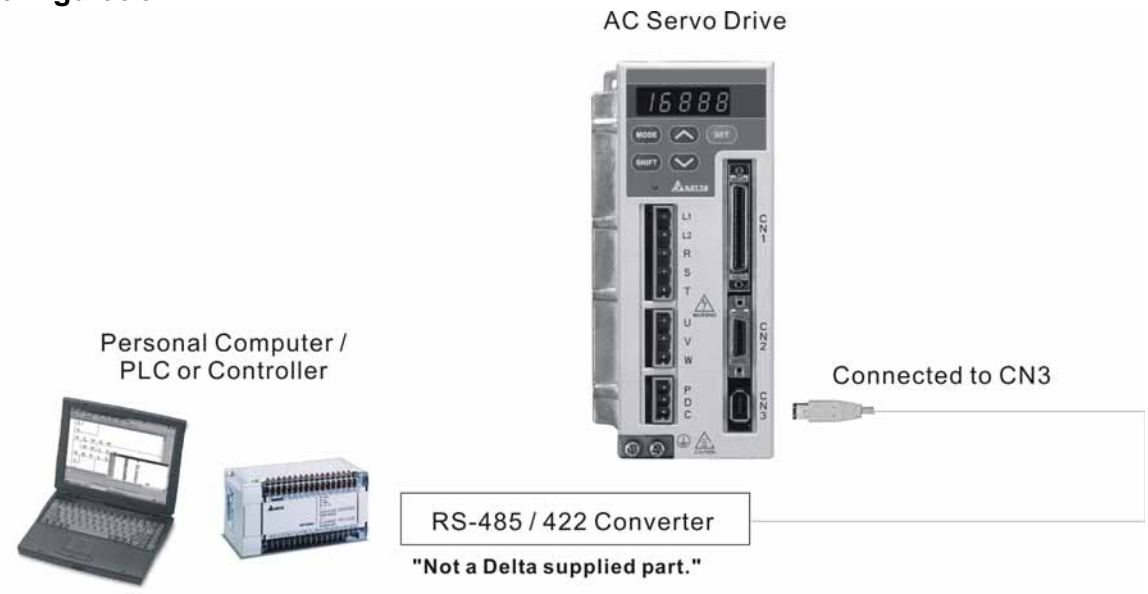
Note:

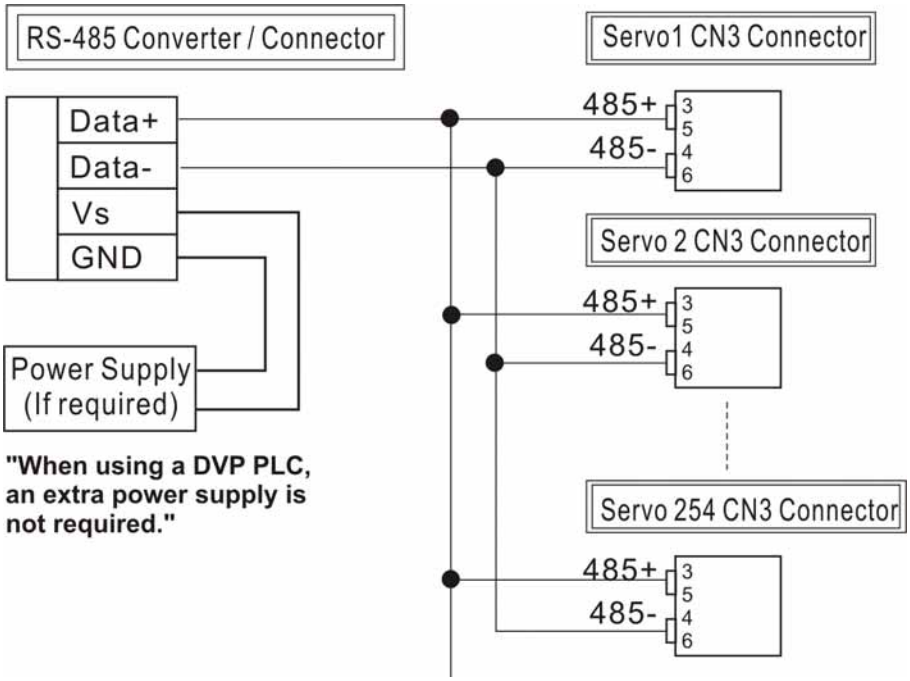
1. **Recommended maximum cable length is 15m. Please note, RFI / EME noise should be kept to a minimum, communication cable should kept apart from high voltage wires. If a transmission speed of 38400 bps or greater is required, the maximum length of the communication cable is 3m which will ensure the correct and desired baud rate.**
2. **The number shown in the pervious figure indicates the terminal number of each connector.**

RS-485, RS-422

■ Configuration



■ Cable Connection



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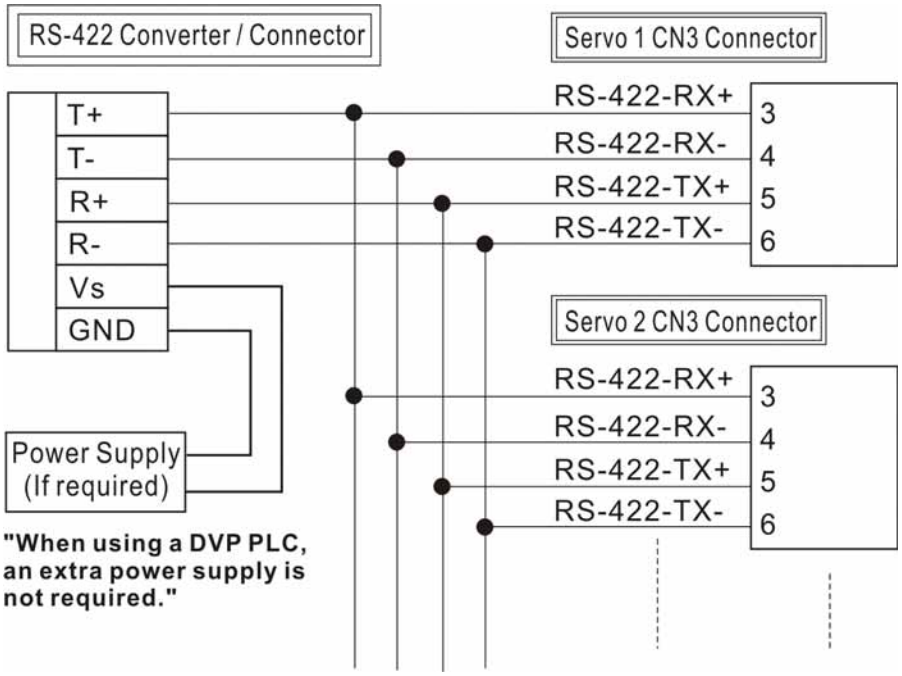

Note:

1. **Recommended maximum cable length is 100m. Please note, RFI / EME noise should be kept to a minimum, communication cable should kept apart from high voltage wires. If a transmission speed of 38400 bps or greater is required the maximum length of the communication cable is 15m which will ensure the correct and desired baud rate.**
2. **The number shown in the pervious figure indicates the terminal number of each connector.**
3. **The power supply should provide a +12V and higher DC voltage.**
4. **Please use a REPEATER if more than 32 synchronous axes are required. A maximum number of 254 axes (drives or RS-482 / RS-422 devices) can be connected.**
5. **For the terminal identification of CN3, please refer to section 3-5.**

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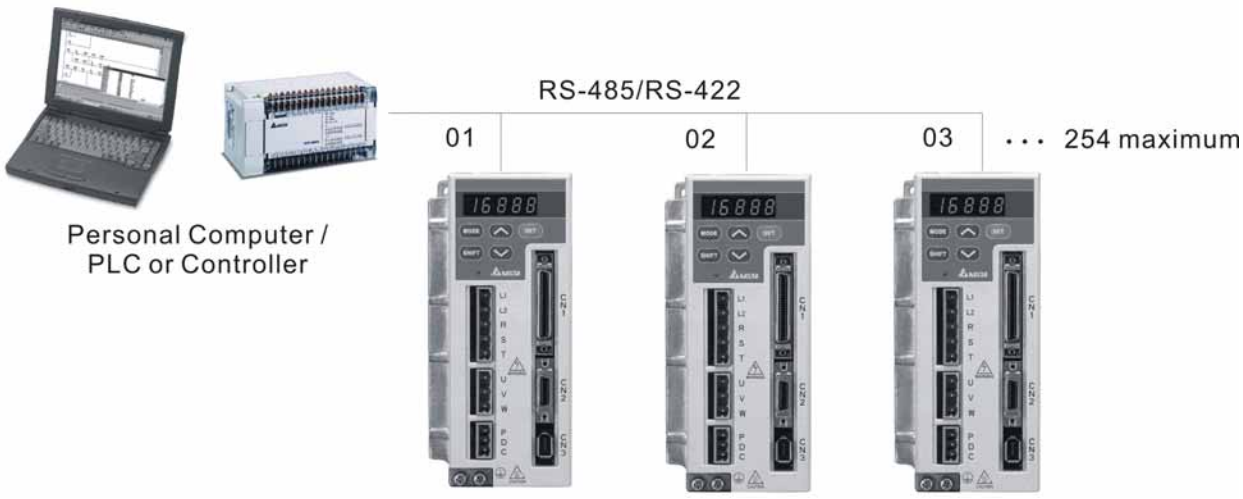
8-2 Communication Parameter Settings

The following describes the communication addresses for the communication parameters. For communication parameters, please refer to the Chapter 7. Communication Addresses 0301, 0302, and 0305 have to be set identically for all the drives and devices to communicate correctly.

0300H Communication Address	Range: 1~254

If the AC servo drive is controlled by RS-232/485/422 communication, each drive (or device) must be uniquely identified and addressed between 1 and 254. Access to program this number is via parameter P3-00.



0301H Transmission Speed	Settings: 0: Baud rate 4800 (data transmission speed: bits / second) 1: Baud rate 9600 (data transmission speed: bits / second) 2: Baud rate 19200 (data transmission speed: bits / second) 3: Baud rate 38400 (data transmission speed: bits / second) 4: Baud rate 57600 (data transmission speed: bits / second) 5: Baud rate 115200 (data transmission speed: bits / second)

This parameter is used to set the desired transmission speed between the computer and AC servo drive. Users can set this parameter and control transmission speed to reach the maximum baud rate of 115200 bps.

0302H Communication Protocol	Settings: 0: Modbus ASCII mode, <7,N,2> 1: Modbus ASCII mode, <7,E,1 > 2: Modbus ASCII mode, <7,O,1> 3: Modbus ASCII mode, <8,N,2 > 4: Modbus ASCII mode, <8,E,1> 5: Modbus ASCII mode, <8,O,1> 6: Modbus RTU mode, <8,N,2> 7: Modbus RTU mode, <8,E,1> 8: Modbus RTU mode, <8,O,1>

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This parameter is used to set the communication protocol. The alphanumeric characters represent the following: 7 or 8 is the number of data bits; N, E or O refer to the parity bit, Non, Even or Odd; the 1 or 2 is the numbers of stop bits.

0303H Transmission Fault Treatment	Settings: 0: Display fault and continue operating 1: Display fault and stop operating

This parameter is used to determine the operating sequence once a communication fault has been detected. If '1' is selected the drive will stop operating upon detection the communication fault. The mode of stopping is set by parameter P1-32.

0304H Communication Time Out Detection	Watch Dog Timer (It is not recommended to change the factory default setting if not necessary) Range: 0~20 The factory default setting is set to 0 and it indicates this function is disabled.

When this parameter is set to any value over 0, it indicates that the timer is enabled. The value set in this parameter is the communication time and the communication time out detection should be completed within the time. Otherwise, a communication error will occur.

For example, if the value set in this parameter is 5, it indicates that the communication time out detection will be activated once in five seconds or a communication error will occur.

0305H Communication Mode	Communication selection: Settings: 0: RS-232 1: RS-422 2: RS-485

Multiple communication modes RS232, RS-485, RS-422 cannot be used within one communication ring.

0306H Communication Function	Digital Input Contact Control: Settings: 0~FFFF (hexadecimal number)

The setting of this parameter determines how the Digital Inputs (DI) accept commands and signals.

Input commands or signals through the DI can be either from an external source, through the CN 1 interface connector, or via communication, (RS-232, RS-485, RS-422). If the Digital Input Contact Control parameter for the DI 1 ~ 8 is set to "0", command is external, and via CN1; if it is set to "1" (decimal number) the DI signal is via communication. Each of the eight Digital Inputs are accessed individually and can be set independently of each other. They can be programmed either via the drive's keypad or via communication and computer UI. If they are programmed via the keypad a hexadecimal number is entered; if programmed via communication or UI a decimal or hexadecimal number can be used. In both methods of programming, a single number is used for all eight Digital Inputs. The following example shows how each DI is addressed and converted to a single decimal or hexadecimal number.

The eight Digital Inputs are noted from the right, DI 1 to left, DI 8 with their desired input command or signal method, 0 or 1. Once all eight Digital Inputs have been noted this binary number is converted to a decimal or hexadecimal number and entered into P3-06.

Bit	8	7	6	5	4	3	2	1
Decimal value	128	64	32	16	8	4	2	1

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Input	DI8	DI7	DI6	DI5	DI4	DI3	DI2	DI1	
State	1	1	0	1	1	0	0	0	= D8 Hex (Keypad, Communication or UI)
(External CN1 Communication)									or = 216 Dec (Communication or UI only)

Please see Chapter 4-4-5 DI Signal Display Diagnosis Operation for display layout of the Digital Signal selection.

The Digital Input Control Contact parameter, P3-06 also works in conjunction with the Multi Function Digital Input parameter P4-07 which has several functions.

The contents of P4-07 is "read only" via the drive keypad and will display the state on or off ("blank" or "|") of the eight Digital Inputs which have been set in accordance to P3-06. For Example; if P3-06 has been set to 0 (All DI is external and via the CN 1 interface) and the P4-07 display is indicating the following:

_ | | | _ _ _ | (for the manual this picture should be similar to the one shown on page 4-8 (Ch 4-4-5)

The Digital Inputs 1, 5, 6, & 7 are "on" (high) and Digital Inputs 2, 3, 4, & 8 are "off" (low).

If the contents of P4-07 is being read via communication the output will be a decimal number that will represent the "binary" display. Therefore in the previous example the decimal number being read would be 113.

However, in the communication mode the user can write to P4-07 to turn the Digital Inputs either "on" or "off". Again this achieved by sending a decimal or hexadecimal number that corresponds to the binary representation of the Digital Inputs being addressed. Therefore in the previous example 113 or 71 hex would be sent to 407H to switch on Digital Inputs 1, 5, 6, & 7. Remember, previous to this P3-06 would have been set to either 255 / FF or 113 / 71 (This sets the Digital Inputs 1, 5, 6, & 7 to communication).

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8-3 MODBUS Communication Protocol

When using RS-232/485/422 serial communication interface, each ASDA-A series AC servo drive has a pre-assigned communication address specified by parameter “P3-00”. The computer then controls each AC servo drive according to its communication address. ASDA-A series AC servo drive can be set up to communicate on a MODBUS networks using on of the following modes: ASCII (American Standard Code for Information Interchange) or RTU (Remote Terminal Unit). Users can select the desired mode along with the serial port communication protocol in parameter “P3-02”.

■ Code Description:

ASCII Mode:

Each 8-bit data is the combination of two ASCII characters. For example, a 1-byte data: 64 Hex, shown as ‘64’ in ASCII, consists of ‘6’ (36Hex) and ‘4’ (34Hex).

The following table shows the available hexadecimal characters and their corresponding ASCII codes.

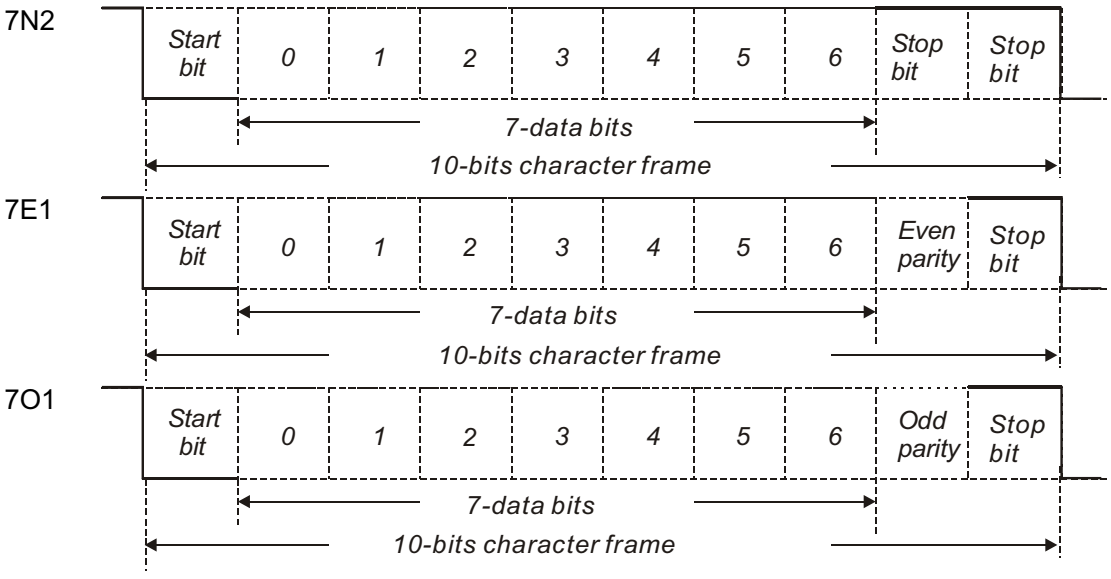
Character	‘0’	‘1’	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’
ASCII code	30H	31H	32H	33H	34H	35H	36H	37H
Character	‘8’	‘9’	‘A’	‘B’	‘C’	‘D’	‘E’	‘F’
ASCII code	38H	39H	41H	42H	43H	44H	45H	46H

RTU Mode:

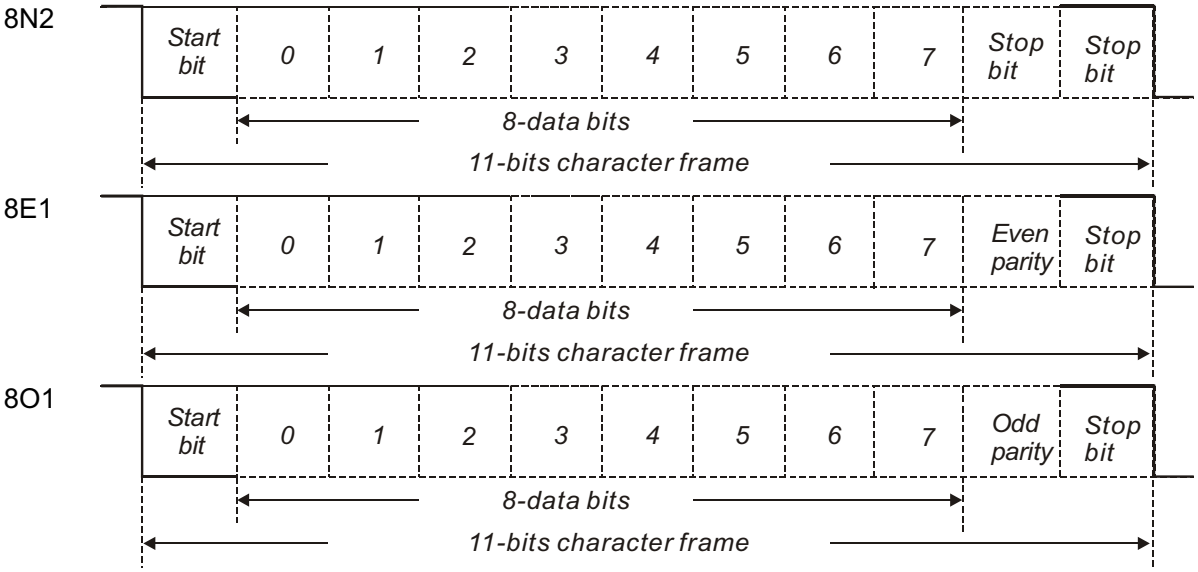
Each 8-bit data is the combination of two 4-bit hexadecimal characters. For example, a 1-byte data: 64 Hex.

■ Data Format:

10-bit character frame (For 7-bit character)



11-bit character frame (For 8-bit character)



■ Communication Protocol:

ASCII Mode:

STX	Start character': ' (3AH)
ADR	Communication address: 1-byte consists of 2 ASCII codes
CMD	Command code: 1-byte consists of 2 ASCII codes
DATA(n-1)	Contents of data: n word = n x 2-byte consists of n x 4 ASCII codes, n≤12
…….	
DATA(0)	
LRC	Command code: 1-byte consists of 2 ASCII codes
End 1	End code 1: (0DH)(CR)
End 0	End code 0: (0AH)(LF)

RTU Mode:

STX	A silent interval of more than 10ms
ADR	Communication address: 1-byte
CMD	Command code: 1-byte
DATA(n-1)	Contents of data: n word = n x 2-byte, n≤12
…….	
DATA(0)	
CRC	Command code: 1-byte
End 1	A silent interval of more than 10ms

STX (Communication Start)

ASCII Mode: ':' character

RTU Mode: A silent interval of more than 10ms

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ADR (Communication Address)

The valid communication addresses are in the range of 1 to 254.

For example, communication to AC servo drive with address 16 decimal:

ASCII Mode: ADR='1','0' => '1'=31H , '0'=30H

RTU Mode: ADR = 10H

CMD (Command Codes) and DATA (Data Characters)

The format of data characters depends on the command code. The available command codes and examples for AC servo drive are described as follows:

Command code: 03H, read N words. The maximum value of N is 10.

For example, reading continuous 2 words from starting address 0200H of AC servo drive with address 01H.

ASCII Mode:

Command message:

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'3'
Starting data address	'0'
	'2'
	'0'
	'0'
Number of data	'0'
	'0'
	'0'
	'2'
LRC Check	'F'
	'8'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response message:

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'3'
Number of data (Count by byte)	'0'
	'4'
Contents of starting data address 0200H	'0'
	'0'
	'B'
	'1'
Contents of second data address 0201H	'1'
	'F'
	'4'
	'0'
LRC Check	'E'
	'8'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU Mode:

Command message:

ADR	01H
CMD	03H
Starting data address	02H (Upper bytes)
	00H (Lower bytes)
Number of data (Count by word)	00H
	02H
CRC Check Low	C5H (Lower bytes)
CRC Check High	B3H (Upper bytes)

Response message:

ADR	01H
CMD	03H
Number of data (Count by byte)	04H
Contents of starting data address 0200H	00H (Upper bytes)
	B1H (Lower bytes)
Contents of second data address 0201H	1FH (Upper bytes)
	40H (Lower bytes)
CRC Check Low	A3H (Lower bytes)
CRC Check High	D4H (Upper bytes)

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Command code: 06H, write 1 word

For example, writing 100 (0064H) to starting data address 0200H of ASDA-A series with address 01H.

ASCII Mode:

Command message:

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'6'
Starting data address	'0'
	'2'
	'0'
	'0'
Content of data	'0'
	'0'
	'6'
	'4'
LRC Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Response message:

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'6'
Starting data address	'0'
	'2'
	'0'
	'0'
Content of data	'0'
	'0'
	'6'
	'4'
LRC Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU Mode:

Command message:

ADR	01H
CMD	06H
Starting data address	02H (Upper bytes)
	00H (Lower bytes)
Content of data	00H (Upper bytes)
	64H (Lower bytes)
CRC Check Low	89H (Lower bytes)
CRC Check High	99H (Upper bytes)

Response message:

ADR	01H
CMD	06H
Starting data address	02H (Upper bytes)
	00H (Lower bytes)
Content of data	00H (Upper bytes)
	64H (Lower bytes)
CRC Check Low	89H (Lower bytes)
CRC Check High	99H (Upper bytes)

CHK (check sum)

LRC (ASCII Mode):

LRC (Longitudinal Redundancy Check) is calculated by summing up, module 256, the values of the bytes from ADR to last data character then calculating the hexadecimal representation of the 2's-complement negation of the sum.

For example, reading 1 word from address 0201H of the ASDA-A series AC servo drive with address 01H.

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'3'
Starting data address	'0'
	'2'
	'0'

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	‘1’
Number of data	‘0’
	‘0’
	‘0’
	‘1’
LRC Check	‘F’
	‘8’
End 1	(0DH)(CR)
End 0	(0AH)(LF)

01H+03H+02H+01H+00H+01H = 08H, the 2’s complement negation of 08H is F8H.
Hence, we can know that LRC CHK is ’F’,’8’.

CRC (RTU Mode):

CRC (Cyclical Redundancy Check) is calculated by the following steps:

Step 1: Load a 16-bit register (called CRC register) with FFFFH.

Step 2: Exclusive OR the first 8-bit byte of the command message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.

Step 3: Extract and examine the LSB. If the LSB of CRC register is 0, shift the CRC register one bit to the right. If the LSB of CRC register is 1, shift the CRC register one bit to the right, then Exclusive OR the CRC register with the polynomial value A001H.

Step 4: Repeat step 3 until eight shifts have been performed. When this is done, a complete 8-bit byte will have been processed, then perform step 5.

Step 5: Repeat step 2 to step 4 for the next 8-bit byte of the command message.

Continue doing this until all bytes have been processed. The final contents of the CRC register are the CRC value.

Note: When transmitting the CRC value in the message, the upper and lower bytes of the CRC value must be swapped, i.e. the lower order byte will be transmitted first.

For example, reading 2 words from address 0101H of the AC servo drive with address 01H. The final content of the CRC register from ADR to last data character is 3794H, then the command message is shown as follows. What should be noticed is that 94H have to be transmitted before 37H.

Command Message	
ADR	01H
CMD	03H
Starting data address	01H (Upper byte)
	01H (Lower bytes)
Number of data (Count by word)	00H (Upper bytes)
	02H (Lower bytes)
CRC Check Low	94H (Lower bytes)
CRC Check High	37H (Upper bytes)

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End1, End0 (Communication End)

ASCII Mode:

In ASCII mode, (0DH) stands for character '\r' (carriage return) and (0AH) stands for character '\n' (new line), they indicate communication end.

RTU Mode:

In RTU mode, a silent interval of more than 10ms indicates communication end.

The following is an example of CRC generation using C language. The function takes two arguments:

```
unsigned char* data;
unsigned char length
```

The function returns the CRC value as a type of unsigned integer.

```
unsigned int crc_chk(unsigned char* data, unsigned char length) {
      int j;
      unsigned int reg_crc=0xFFFF;

      while( length-- ) {
            reg_crc^= *data++;
            for (j=0; j<8; j++ ) {
                  if( reg_crc & 0x01 ) { /*LSB(bit 0 ) = 1 */
                        reg_crc = (reg_crc >> 1)^0xA001;
                  } else {
                        reg_crc = (reg_crc>>1);
                  }
            }
      }
      return reg_crc;
}
```

PC communication program example:

```
#include<stdio.h>
#include<dos.h>
#include<conio.h>
#include<process.h>
#define PORT 0x03F8          /*  the address of COM 1  */
#define THR 0x0000
#define RDR 0x0000
#define BRDL 0x0000
```

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```
#define IER 0x0001
#define BRDH 0x0001
#define LCR 0x0003
#define MCR 0x0004
#define LSR 0x0005
#define MSR 0x0006
unsigned char rdat[60];
/* read 2 data from address 0200H of ASD with address 1 */
unsigned char tdat[60]={':','0','1','0','3','0','2','0','0','0','0','0','2','F','8','\r','\n'};
void main() {
int I;
outportb(PORT+MCR,0x08);          /*  interrupt enable  */
outportb(PORT+IER,0x01);                  /*  interrupt as data in  */
outportb(PORT+LCR,( inportb(PORT+LCR) | 0x80 ) );
/*  the BRDL/BRDH can be access as LCR.b7 == 1  */
outportb(PORT+BRDL,12);
outportb(PORT+BRDH,0x00);
outportb(PORT+LCR,0x06);          /* set prorocol
                                        <7,E,1> = 1AH,          <7,O,1> = 0AH
                                        <8,N,2> = 07H       <8,E,1> = 1BH
                                        <8,O,1> = 0BH                          */

for( I = 0; I<=16; I++ ) {
    while( !(inportb(PORT+LSR) & 0x20) ); /*  wait until THR empty  */
    outportb(PORT+THR,tdat[I]);           /*  send data to THR  */
}
I = 0;
while( !kbhit() ) {
    if( inportb(PORT+LSR)&0x01 ) {  /*  b0==1, read data ready  */
        rdat[I++] = inportb(PORT+RDR); /*   read data from RDR  */
    }
}
}
```

8-4 Communication Parameter Write-in and Read-out

There are following five groups for parameters:

Group 0: Monitor parameter	(example: P0-xx)
Group 1: Basic parameter	(example: P1-xx)
Group 2: Extension parameter	(example: P2-xx)
Group 3: Communication parameter	(example: P3-xx)
Group 4: Diagnosis parameter	(example: P4-xx)

For a complete listing and description of all parameters, refer to Chapter 7.

Communication write-in parameters for ASDA-A series are including:

Group 0: P0-02 ~ P0-16 (0002H to 0010H)
Group 1: P1-00 ~ P1-56 (0100H to 0138H)
Group 2: P2-00 ~ P2-64 (0200H to 0240H)
Group 3: P3-00 ~ P3-07 (0300H to 0307H)
Group 4: P4-05 ~ P4-23 (0405H to 0417H)

🕮 Note:

P3-01 After the new transmission speed is set, the next data will be written in new transmission speed.

P3-02 After the new communication protocol is set, the next data will be written in new communication protocol.

P4-05 JOG control of servo motor. For the description, refer to Chapter 7.

P4-06 Force output contact control. This parameter is for the users to test if DO (Digit output) is normal. User can set 1, 2, 3, 4, 5 to test DO0, DO1, DO2, DO3, DO4, respectively. After the test has been completed, please set this parameter to 0 to inform the drive that the test has been completed.

P4-10 Adjustment function selection. If user desires to change the settings of this parameter, user has to set the value of the parameter P2-08 to 20 (hexadecimal: 14H) first and then restart. After restarting, the settings of parameter P4-10 can become modified.

P4-11 ~ P4-21 These parameters are for offset adjustment. Do not change the factory default setting if not necessary. If the user desires to change the settings of these parameters, the user has to set the value of the parameter P2-08 to 22 (hexadecimal: 16H) first and then restart. After restarting, the settings of parameters P4-11 to P4-21 can become modified.

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Communication read-out parameters for ASDA-A series are including:

Group 0: P0-00 ~ P0-08 (0000H to 0008H)

Group 1: P1-00 ~ P1-56 (0100H to 0138H)

Group 2: P2-00 ~ P2-64 (0200H to 0240H)

Group 3: P3-00 ~ P3-07 (0300H to 0307H)

Group 4: P4-00 ~ P4-23 (0400H to 0417H)

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Chapter 9 Maintenance and Inspection

Delta AC servo drives are based on solid state electronics technology. Preventive maintenance is required to operate this AC servo drives in its optimal condition, and to ensure a long life. It is recommended to perform a periodic maintenance and inspection of the AC servo drive by a qualified technician. Before any maintenance and inspection, always turn off the AC input power to the unit.

⚠WARNING Be sure to disconnect AC power and ensure that the internal capacitors have fully discharged before performing the maintenance and inspection!

9-1 Basic Inspection

After power is in connected to the AC servo drive, the charge LED will be lit which indicates that the AC servo drive is ready.

Inspection Item	Inspection Content
General Inspection	1. Periodically inspect the screws of the servo drive, motor shaft, terminal block and the connection to mechanical system. Tighten screws as necessary as they may loosen due to vibration and varying temperatures. 2. Ensure that oil, water, metallic particles or any foreign objects do not fall inside the servo drive, motor, control panel or ventilation slots and holes. As there will cause damage. 3. Ensure the correct installation and the control panel. It should be free from airborne dust, harmful gases or liquids. 4. Ensure that all wiring instructions and recommendations are followed, otherwise damage to the drive and or motor may result.
Inspection before operation (Control power is not applied)	1. Ensure that all wiring terminals are correctly insulated. 2. Ensure that all wiring is correct or damage and or malfunction may result. 3. Visually check to ensure that there are not any unused screws, metal strips, or any conductive or inflammable materials inside the drive. 4. To avoid an electric shock, be sure to connect the ground terminal of servo drive to the ground terminal of control panel. Before making any connection, wait 10 minutes for capacitors to discharge after the power is disconnected, alternatively, use an appropriate discharge device to discharge. 5. Make sure control switch is OFF. 6. Never put inflammable objects on servo drive or close to the external regenerative resistor. 7. If the electromagnetic brake is being used, ensure that it is correctly wired. 8. If required, use an appropriate electrical filter to eliminate noise to the servo drive. 9. Ensure that the external applied voltage to the drive is correct and matched to the controller.

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Inspection Item	Inspection Content
Inspection during operation (Control power is applied)	1. Ensure that the cables are not damaged, stressed excessively or loaded heavily. When the motor is running, pay close attention on the connection of the cables and notice that if they are damaged, frayed or over extended. 2. Check for abnormal vibrations and sounds during operation. If the servo motor is vibrating or there are unusual noises while the motor is running, please contact the distributor or manufacturer for assistance. 3. Ensure that all user defined parameters are set correctly. 4. Reset parameters when the servo drive is off. Otherwise, it may result in malfunction. 5. Ensure correct operation when using a relay and request assistance should there be any unusual noises. 6. Check for abnormal conditions of the power indicators and LED display.

9-2 Maintenance

- Use and store the product in a proper and normal environment.
- Periodically clean the surface and panel of servo drive and motor.
- Make sure the conductors or insulators are corroded and/or damaged.
- Do not disassemble or damage any mechanical part when performing maintenance.
- Clean off any dust and dirt with a vacuum cleaner. Place special emphasis on cleaning the ventilation ports and PCBs. Always keep these areas clean, as accumulation of dust and dirt can cause unforeseen failures.

9-3 Life of Replacement Components

- **Smooth capacitor**

  The characteristics of smooth capacitor would be deteriorated by ripple current affection. The life of smooth capacitor varies according to ambient temperature and operating conditions. The common guaranteed life of smooth capacitor is ten years when it is properly used in normal air-conditioned environment.

- **Relay**

  The contacts will wear and result in malfunction due to switching current. The life of relay varies according to power supply capacity. Therefore, the common guaranteed life of relay is cumulative 100,000 times of power on and power off.

- **Cooling fan**

  The cooling fan life is limited and should be changed periodically. The cooling fan will reach the end of its life in 2~3 years when it is in continuous operation. However, it also must be replaced if the cooling fan is vibrating or there are unusual noises.

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Chapter 10 Troubleshooting

10-1 Fault Messages Table

If a fault is detected on the servo drive or motor a corresponding fault code will be shown on the drive's LED display. Fault codes can also be transmitted via communication, see P0-01 and P4-00 ~ P4-04 for display on controller or HMI.

Fault Messages		
Display	**Fault Name**	**Fault Description**
AL001	Overcurrent	Main circuit current is higher than 1.5 multiple of motor's instantaneous maximum current value.
AL002	Overvoltage	Main circuit voltage has exceeded its maximum allowable value.
AL003	Undervoltage	Main circuit voltage is below its minimum specified value.
AL004	Motor overheated	The motor's operating temperature is higher than the upper-limit of the specification.
AL005	Regeneration error	Regeneration control operation is error.
AL006	Overload	Servo motor and drive is overload.
AL007	Overspeed	Motor's control speed exceeds the limit of normal speed.
AL008	Abnormal pulse control command	Input frequency of pulse command exceeds the limit of its allowable setting value.
AL009	Excessive deviation	Position control deviation value exceeds the limit of its allowable setting value.
AL010	Watch dog execution time out	Watch dog execution time out.
AL011	Encoder error	Pulse signal is error.
AL012	Adjustment error	Adjusted value exceeds the limit of its allowable setting value when perform electrical adjustment.
AL013	Emergency stop activated	Emergency stop switch is disabled.
AL014	Reverse limit switch error	Reverse limit switch is disabled.
AL015	Forward limit switch error	Forward limit switch is disabled.
AL016	IGBT temperature error	Temperature of IGBT is over high.
AL017	Memory error	EE-PROM write-in and read-out is error.
AL018	DSP communication error	DSP communication is error.
AL019	Serial communication error	RS232/485 communication is error.
AL020	Serial communication time out	RS232/485 communication time out.
AL021	Command write-in error	Control command write-in error.
AL022	Input power phase loss	One phase of the input power is loss.

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10-2 Potential Cause and Corrective Actions

ALE01 : Overcurrent

Potential Cause	Checking Method	Corrective Actions
Short-circuit at drive output	1.Check the wiring connections between drive and motor. 2.Check if the wire is short-circuited.	Repair the short-circuited and avoid metal conductor being exposed.
Motor wiring error	Check if the wiring steps are all correct when connecting motor to drive.	Follow the wiring steps in the user manual to reconnect wiring.
IGBT error	Heat sink overheated	Return to the distributor or manufacturer.
Control parameter setting error	Check if the setting value exceeds the factory default setting.	Set the setting back to factory default setting and then reset and adjust the parameter setting again.
Control command setting error	Check if the control input command is unstable (fluctuate too much).	1. Ensure that input command frequency is stable (not fluctuate too much). 2. Activate filter function.

ALE02 : Overvoltage

Potential Cause	Checking Method	Corrective Actions
The main circuit voltage has exceeded its maximum allowable value.	Use voltmeter to check whether the input voltage falls within the rated input voltage.	Use correct power supply or serial stabilizator.
Input power error (Incorrect power input)	Use voltmeter to check whether the input voltage is within the specified limit.	Use correct power supply or serial stabilizator.

ALE03 : Undervoltage

Potential Cause	Checking Method	Corrective Actions
The main circuit voltage is below its minimum specified value.	Check whether the wiring of main circuit input voltage is normal.	Reconfirm voltage wiring.
No input voltage at main circuit.	Use voltmeter to check whether input voltage at main circuit is normal.	Reconfirm power switch.
Input power error (Incorrect power input)	Use voltmeter to check whether the input voltage is within the specified limit.	Use correct power supply or serial stabilizator.

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AL004 : Motor overheated

Potential Cause	Checking Method	Corrective Actions
Servo system is overloaded.	1. Use thermometer to check the motor temperature. 2. Check if servo system is overloaded.	Estimate the capacity of motor and drive again.

AL005 : Regeneration error

Potential Cause	Checking Method	Corrective Actions
Regenerative resistor is not connected.	Check the wiring connection of regenerative resistor.	Reconnect regenerative resistor.
Regenerative switch transistor fault	Check if regenerative switch transistor is short-circuited.	Return to the distributor or manufacturer.
Parameter setting error	Confirm the parameter setting and specifications of regenerative resistor.	Correctly reset again.

AL006 : Overload

Potential Cause	Checking Method	Corrective Actions
The drive has exceeded its rated load during continuous operation.	Check if the drive is overloaded.	Increase motor capacity or reduce load.
Control system parameter setting is defective.	Check if mechanical system is vibrating.	Adjust gain value of control circuit.
	Accel/decel setting time is too fast.	Decrease accel/decel setting time.
The wiring of motor and position detector is error.	Check the wiring of U, V, W and position detector.	Make sure to wire correctly.

AL007 : Overspeed

Potential Cause	Checking Method	Corrective Actions
Speed input command is not stable (not fluctuate too much).	Use signal detector to detect if input signal is abnormal.	1. Ensure that input command frequency is stable (not fluctuate too much) 2. Activate filter function.
Over-speed parameter setting is defective.	Check if over-speed parameter setting value is too small.	Correctly set over-speed parameter setting again.

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AL.E08 : Abnormal pulse control command

Potential Cause	Checking Method	Corrective Actions
Pulse command frequency is higher than rated input frequency.	Use pulse frequency detector to detect input frequency.	Correctly set the input pulse frequency.

AL.E09 : Excessive deviation

Potential Cause	Checking Method	Corrective Actions
Maximum deviation parameter setting is too small.	Check for the maximum deviation parameter setting.	Increase setting value.
Gain value is too small.	Check if the setting value is correct.	Correctly adjust gain value.
Torque limit is over low.	Check torque limit value.	Correctly adjust torque limit value.
There is an overload.	Check load condition.	1. Reduce external applied load. 2. Estimate the motor capacity again.

AL.E10 : Watch dog execution time out

Potential Cause	Checking Method	Corrective Actions
Watch dog execution error.	Check and reset the power supply.	If there are any abnormal conditions after resetting the power supply, returned to the distributor or manufacturer.

AL.E11 : Encoder error

Potential Cause	Checking Method	Corrective Actions
The wiring of encoder is error.	1. Check if the wiring is correct. 2. Check if user performs wiring by following the user manual.	Make sure to wire correctly.
Encoder is loose.	Examine encoder connector	Re-install.
The wiring of encoder is defective.	Inspect whether wire is loose or not.	Reconnect the wiring again.
Encoder is damaged.	Motor is abnormal.	Remove motor

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ALE12 : Adjustment error

Potential Cause	Checking Method	Corrective Actions
Analog input contact does not correctly return to zero.	Measure and check if the voltage level of analog input contact is the same as the electrical potential of grounding.	Correctly ground analog input contact.
Detection device may be damaged.	Check and reset the power supply.	If the error does not clear after resetting the power supply, contact the distributor for assistance or return to manufacturer.

ALE13 : Emergency stop activated

Potential Cause	Checking Method	Corrective Actions
Emergency stop switch is disabled.	Check if emergency stop switch is On or Off.	Activate emergency stop switch.

ALE14 : Reverse limit switch error

Potential Cause	Checking Method	Corrective Actions
Reverse limit switch is disabled.	Check if reverse limit switch is On or Off.	Activate reverse limit switch.
Servo system is not stable.	Check the value of control parameter setting and load inertia.	Modify parameter setting and estimate motor capacity again.

ALE15 : Forward limit switch error

Potential Cause	Checking Method	Corrective Actions
Forward limit switch is disabled.	Check if forward limit switch is On or Off.	Activate forward limit switch.
Servo system is not stable.	Check the value of control parameter setting and load inertia.	Modify parameter setting and estimate motor capacity again.

ALE16 : IGBT temperature error

Potential Cause	Checking Method	Corrective Actions
The drive has exceeded its rated load during continuous operation.	Check if there is overload or the motor current is too high.	Increase motor capacity or reduce load.
Short-circuit at drive output	Check the drive input wiring.	Make sure to wire correctly.

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ALE17 : Memory error

Potential Cause	Checking Method	Corrective Actions
Data in Memory read-out / write-in error	Reset parameter or power supply.	If the error does not clear after resetting the parameter or power supply, contact the distributor for assistance or return to manufacturer.

ALE18 : DSP communication error

Potential Cause	Checking Method	Corrective Actions
Control power is error	Check and reset control power	If the error does not clear after resetting the power supply, contact the distributor for assistance or return to manufacturer.

ALE19 : Serial communication error

Potential Cause	Checking Method	Corrective Actions
Communication parameter setting is not correct.	Check communication parameter setting.	Make sure parameter setting value is set correctly.
Communication address is not correct	Check communication address.	Make sure the communication address is set correctly.
Communication setting value is not correct	Check read-out and write-in value.	Make sure the communication setting value is correct.

ALE20 : Serial communication time out

Potential Cause	Checking Method	Corrective Actions
Setting value in time out parameter is not correct.	Check the setting of time out parameter.	Make sure the setting value is correct.
Not receiving Communication command for a long time.	Check whether communication cable is loose or break.	Make sure to perform wiring correctly.

ALE21 : Command write-in error

Potential Cause	Checking Method	Corrective Actions
Control power supply is error.	Check and reset control power supply.	If the error does not clear after resetting the power supply, contact the distributor for assistance or return to manufacturer.

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AL022 : Input power phase loss

Potential Cause	Checking Method	Corrective Actions
Input power is error.	1. Check for possible poor connection on the input power line. 2. Check for possible loss of phase on input power line.	Correctly connect three-phase power. If there are any abnormal conditions existed, contact the distributor for assistance or return to manufacturer.

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10-3 Clearing Faults

Display	Fault Name	Clearing Method
	Overcurrent	Turn ARST (DI signal) ON to clear the fault.
	Overvoltage	Turn ARST (DI signal) ON to clear the fault.
	Undervoltage	This fault could be cleared automatically when the main circuit voltage is returned within its specified value.
	Motor overheated	Turn ARST (DI signal) ON to clear the fault.
	Regeneration error	Turn ARST (DI signal) ON to clear the fault.
	Overload	Turn ARST (DI signal) ON to clear the fault.
	Overspeed	Turn ARST (DI signal) ON to clear the fault.
	Abnormal pulse control command	Turn ARST (DI signal) ON to clear the fault.
	Excessive deviation	Turn ARST (DI signal) ON to clear the fault.
	Watch dog execution time out	This fault information could not be cleared.
	Encoder error	This fault information could be removed by restarting the servo drive.
	Adjustment error	This fault information could be removed after removing the wiring of CN1 connector (I/O signal connector) and executing auto adjustment.
	Emergency stop activated	This fault information could be removed automatically by turning off EMGS (DI signal).
	Reverse limit switch error	Turn ARST (DI signal) ON or turn off the servo drive to clear the fault.
	Forward limit switch error	Turn ARST (DI signal) ON or turn off the servo drive to clear the fault.
	IGBT temperature error	Turn ARST (DI signal) ON to clear the fault.
	Memory error	Turn ARST (DI signal) ON to clear the fault.

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Display	Fault Name	Clearing Method
	DSP communication error	Turn ARST (DI signal) ON to clear the fault.
	Serial communication error	Turn ARST (DI signal) ON to clear the fault.
	Serial communication time out	Turn ARST (DI signal) ON to clear the fault.
	Command write-in error	Turn ARST (DI signal) ON to clear the fault.
	Input power phase loss	Turn ARST (DI signal) ON to clear the fault.

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Chapter 11 Specifications

11-1 Servo Drive Specifications (ASDA-A Series)

Model: ASD-A□□□□□□			01	02	04	07	10	15	20	30
Power supply	Voltage / Frequency		Three-phase or Single-phase 220VAC						Three-phase 220VAC	
	Permissible Voltage Fluctuation		Three-phase: 170~255VAC Single-phase: 200~255VAC						170~255VAC	
	Permissible Frequency Fluctuation		50 / 60Hz ±5%							
Cooling System			Natural Air Circulation			Fan Cooling				
Encoder Resolution / Feedback Resolution			2500ppr / 10000ppr							
Control of Main Circuit			SVPWM Control							
Tuning Modes			Easy / Auto / Manual							
Dynamic Brake			Built-in							
Position Control Mode	Max. Input Pulse Frequency		Max. 500KPPS (Line driver) / Max. 200KPPS (Open collector)							
	Pulse Type		Pulse + Direction, A phase + B phase, CCW pulse + CW pulse							
	Command Source		External pulse train / Internal parameters							
	Smoothing Strategy		Low-pass and P-curve filter							
	Electronic Gear		Electronic gear N/M multiple N: 1~32767, M: 1:32767(1/50<N/M<200)							
	Torque Limit Operation		Set by parameters							
	Feed Forward Compensation		Set by parameters							
Speed Control Mode	Analog Input Command	Voltage Range	0 ~ ±10 VDC							
		Input Resistance	10KΩ							
		Time Constant	2.2 μs							
	Speed Control Range*1		1:5000							
	Command Source		External analog signal / Internal parameters							
	Smoothing Strategy		Low-pass and S-curve filter							
	Torque Limit Operation		Set by parameters or via Analog input							
	Frequency Response Characteristic		Maximum 450Hz							
	Speed Fluctuation Rate*2		0.01% or less at load fluctuation 0 to 100% (at rated speed)							
			0.01% or less at power fluctuation ±10% (at rated speed)							
			0.01% or less at ambient temperature fluctuation 0°C to 50°C (at rated speed)							

📖 Note: Please refer to Section 1-2 for details about the model explanation.

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11-1 Servo Drive Specifications (ASDA-A Series), cont.

Model: ASD-A□□□□□□			01	02	04	07	10	15	20	30
Torque Control Mode	Analog Input Command	Voltage Range	0 ~ ±10 VDC							
		Input	10KΩ							
		Time Constant	2.2 μs							
	Permissible Time for		8 sec. Under 200% rated output							
	Command Source		External analog signal / Internal parameters							
	Smoothing Strategy		Low-pass filter							
	Speed Limit Operation		Parameter Setting or via Analog input							
Analog Monitor Output			Monitor signal can set by parameters (Output voltage range: ±8V)							
Digital Input/Output		Input	Servo On, Reset, Gain switching, Pulse clear, Low speed CLAMP, Speed/Torque limit enabled, Emergency stop, Forward / Reverse inhibit limit, Pulse inhibit input, Forward / Reverse JOG input							
			Internal parameter selection, Torque limit activation, Speed limit activation, Control mode selection (Position / Speed / Torque mode selection, Dual mode selection), Feed step control mode, Internal auto running mode, Electronic gear ratio selection							
		Output	Encoder signal output (A, B, Z / Line Driver)							
			Servo ready, Servo On, Zero speed, Speed reached, Positioning completed, Reached torques limits, Servo alarm output (Servo fault), Electromagnetic brake, Home completed							
Protective Functions			Overcurrent, Overvoltage, Undervoltage, Motor overheated, Regeneration error, Overload, Overspeed, Abnormal pulse control command, Excessive deviation, Watch dog execution time out, Encoder error, Adjustment error, Emergency stop activated, Reverse/ Forward limit switch error, IGBT temperature error, Memory error, DSP communication error, Serial communication error, Input power phase loss, Serial communication time out, Command write-in error							
Communication Interface			RS-232 / RS-485 / RS-422							
Environment	Installation Site		Indoor location (free from direct sunlight), no corrosive liquid and gas (far away from oil mist, flammable gas, dust)							
	Altitude		Altitude 1000m or lower above sea level							
	Atmospheric pressure		86kPA to 106kPA							
	Operating Temperature		0°C to 55°C (If operating temperature is above specified range, forced cooling will be required)							
	Storage Temperature		-20°C to 65°C (-4°F to 149°F)							
	Humidity		0 to 90% (non-condensing)							
	Durability of Vibration		9.80665m/s^2 (1G) less than 20Hz, 5.88m/ s^2 (0.6G) 20 to 50Hz							
	Enclosure Rating		IP20							
Terminals with Short Circuit Protection			U, V, W, CN1, CN2, CN3							

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11-1 Servo Drive Specifications (ASDA-A Series), cont.

Model: ASD-A□□□□□□	01	02	04	07	10	15	20	30
Power System	TN System*3							
Standards/Requirement	IEC/EN 61800-5-1, UL 508C, TUV, C-tick							

Footnote:

***1 At rated load, the speed ratio is defined as: Minimum speed (Motor will not pause) / Rated speed**

***2 When command is rated speed, the speed fluctuation rate is defined as: (Speed at zero load - Speed at rated load) / Rated speed**

***3 TN system: A power distribution system having one point directly earthed, the exposed conductive parts of the installation being connected to that points by protective earth conductor.**

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11-2 Low Inertia Servo Motor Specifications (ASMT□□L Series)

Model: ASMT□□L250□□		100W	200W	400W	750W	1kW	2kW	3kW
		01	02	04	07	10	20	30
Specifications	Rated output (kW)	0.1	0.2	0.4	0.75	1.0	2.0	3.0
	Rated torque (N.m)	0.318	0.64	1.27	2.39	3.3	6.8	9.5
	Maximum torque (N.m)	0.95	1.91	3.82	7.16	9.9	19.2	31.5
	Rated speed (rpm)	3000						
	Maximum speed (rpm)	5000					4500	
	Rated current (A)	1.1	1.7	3.3	5.0	6.8	13.4	17.5
	Maximum current (A)	3.0	4.9	9.3	14.1	18.7	38.4	55
	Power rating (kW/s)	34.5	23.0	48.7	51.3	42	98	95.1
	Rotor moment of inertia ($Kg.m^2$)	0.03E-4	0.18E-4	0.34E-4	1.08E-4	2.6E-4	4.7E-4	11.6E-4
	Mechanical time constant (ms)	0.6	0.9	0.7	0.6	1.7	1.2	1.05
	Static friction torque (N.m)	0.02	0.04	0.04	0.08	0.49	0.49	0.49
	Torque constant-KT (N.m/A)	0.32	0.39	0.4	0.5	0.56	0.54	0.581
	Voltage constant-KE (V/rpm)	33.7E-3	41.0E-3	41.6E-3	52.2E-3	58.4E-3	57.0E-3	60.9E-3
	Armature resistance (Ohm)	20.3	7.5	3.1	1.3	2.052	0.765	0.32
	Armature inductance (mH)	32	24	11	6.3	8.4	3.45	2.63
	Electrical time constant (ms)	1.6	3.2	3.2	4.8	4.1	4.5	8.2
	Insulation class	Class F						
	Insulation resistance	>100MΩ, DC 500V						
	Insulation strength	AC 1500 V, 50Hz, 60 seconds						
	Max. radial shaft load (N)	78.4	196	196	343	490	490	490
	Max. thrust shaft load (N)	39.2	68.6	68.6	98	98	98	98
	Vibration grade (um)	15						
	DC brake power (V)	24						
Environment	Operating temperature	0°Cto 40°C (32°F to 104°F)						
	Storage temperature	-20°C to 70°C (-4°F to 158°F)						
	Operating humidity	20 to 90%RH (non-condensing)						
	Storage humidity	20 to 90%RH (non-condensing)						
	Vibration capacity	2.5G						
	Enclosure Rating	IP65 (except shaft and connector)						

📖 Note: Please refer to Section 1-2 for details about the model explanation.

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11-3 Medium Inertia Servo Motor Specifications (ASMT□□M Series)

Model: ASMT□□M250□□		1kW	1.5kW	2kW	3kW
		10	15	20	30
Specifications	Rated output	1.0	1.5	2.0	3.0
	Rated torque (N.m)	4.8	7.16	9.4	14.3
	Maximum torque (N.m)	15.7	21.5	23.5	35.8
	Rated speed (rpm)	2000			
	Maximum speed (rpm)	3000			
	Rated current (A)	5.6	10.6	13.1	17.4
	Maximum current (A)	17.6	30.3	31.4	42.3
	Power rating (kW/s)	38.4	58.3	55.6	47.2
	Rotor moment of inertia ($Kg.m^2$)	5.98E-4	8.79E-4	15.8E-4	43.3E-4
	Mechanical time constant (ms)	1.4	1.3	1.6	0.9
	Static friction torque (N.m)	0.29	0.5	0.98	0.98
	Torque constant-KT (N.m/A)	0.91	0.73	0.77	0.86
	Voltage constant-KE (V/rpm)	95.71E-3	76.0E-3	81.1E-3	90.5E-3
	Armature resistance (Ohm)	1.98	0.828	0.6	0.162
	Armature inductance (mH)	13.2	5.5	6.1	2.3
	Electrical time constant (ms)	6.7	6.6	10.1	14.2
	Insulation class	Class F			
	Insulation resistance	>100MΩ, DC 500V			
	Insulation strength	AC 1500 V, 50 Hz, 60 seconds			
	Max. radial shaft load (N)	490	490	784	784
	Max. thrust shaft load (N)	98	98	392	392
	Vibration grade. (um)	15			
	DC brake power (V)	24			
Environment	Operating temperature	0°Cto 40°C (32°F to 104°F)			
	Storage temperature	-20°C to 70°C (-4°F to 158°F)			
	Operating humidity	20~90%RH (non-condensing)			
	Storage humidity	20~90%RH (non-condensing)			
	Vibration capacity	2.5G			
	Enclosure Rating	IP65 (except shaft and connector)			

📖 Note: Please refer to Section 1-2 for details about the model explanation.

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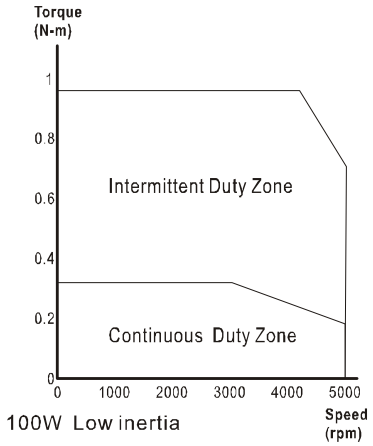
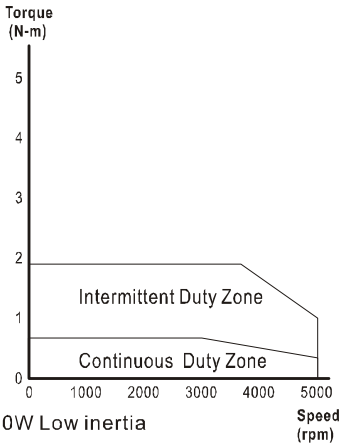
11-4 Servo Motor Speed-Torque Curves

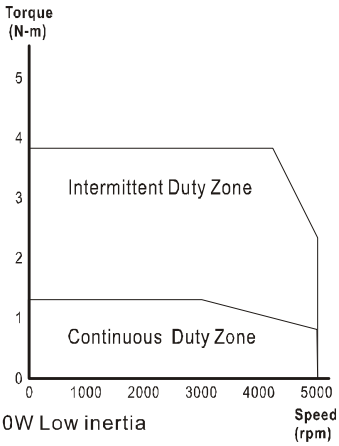
Low Inertial Servo Motor Speed-Torque Curves



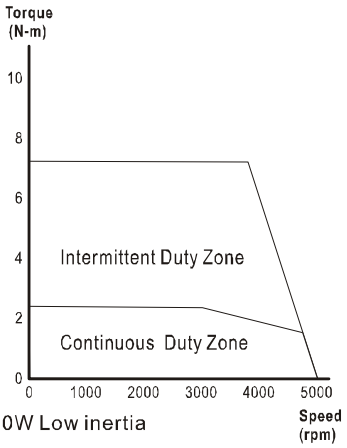
100W Low inertia



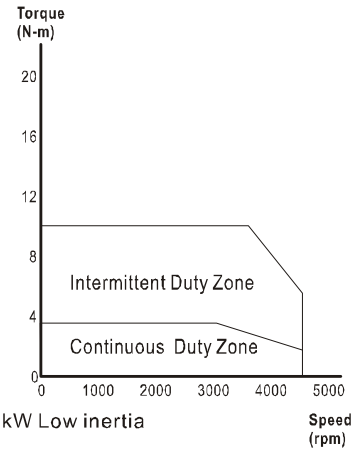
200W Low inertia



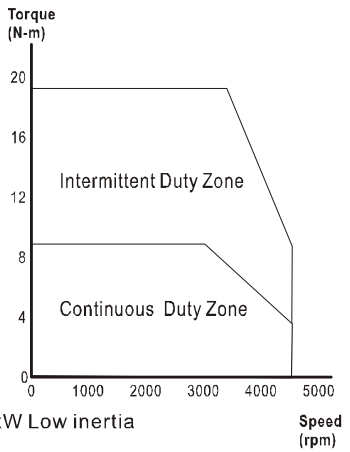
400W Low inertia



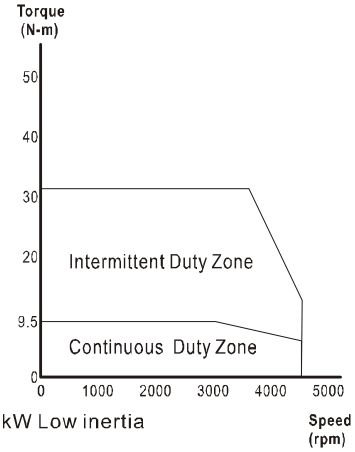
750W Low inertia



1kW Low inertia



2kW Low inertia



3kW Low inertia

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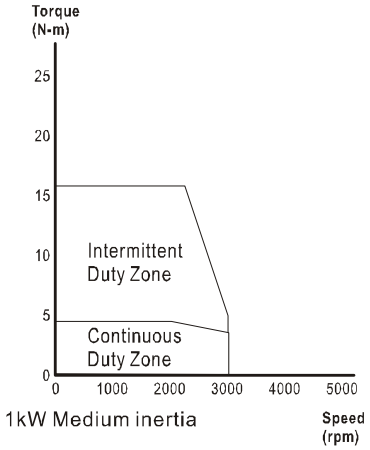
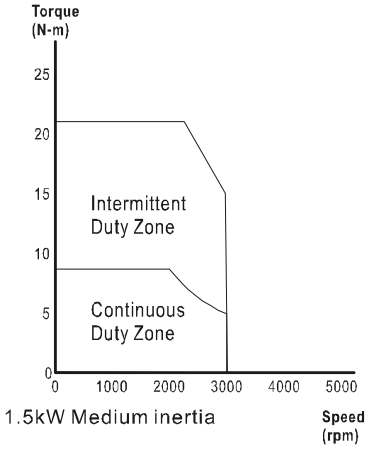
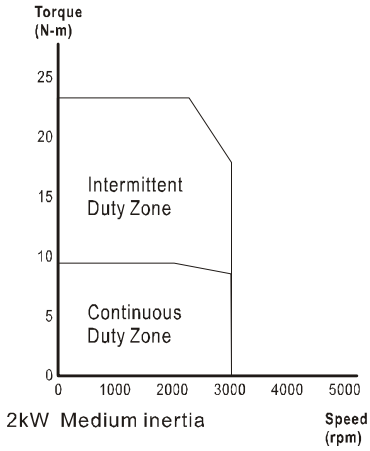
Medium Inertial Servo Motor Speed-Torque Curves



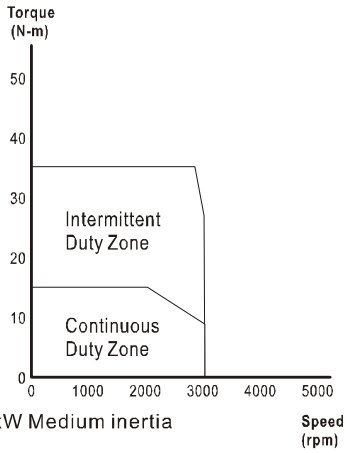
1kW Medium inertia



1.5kW Medium inertia



2kW Medium inertia



3kW Medium inertia

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11-5 Overload Characteristics

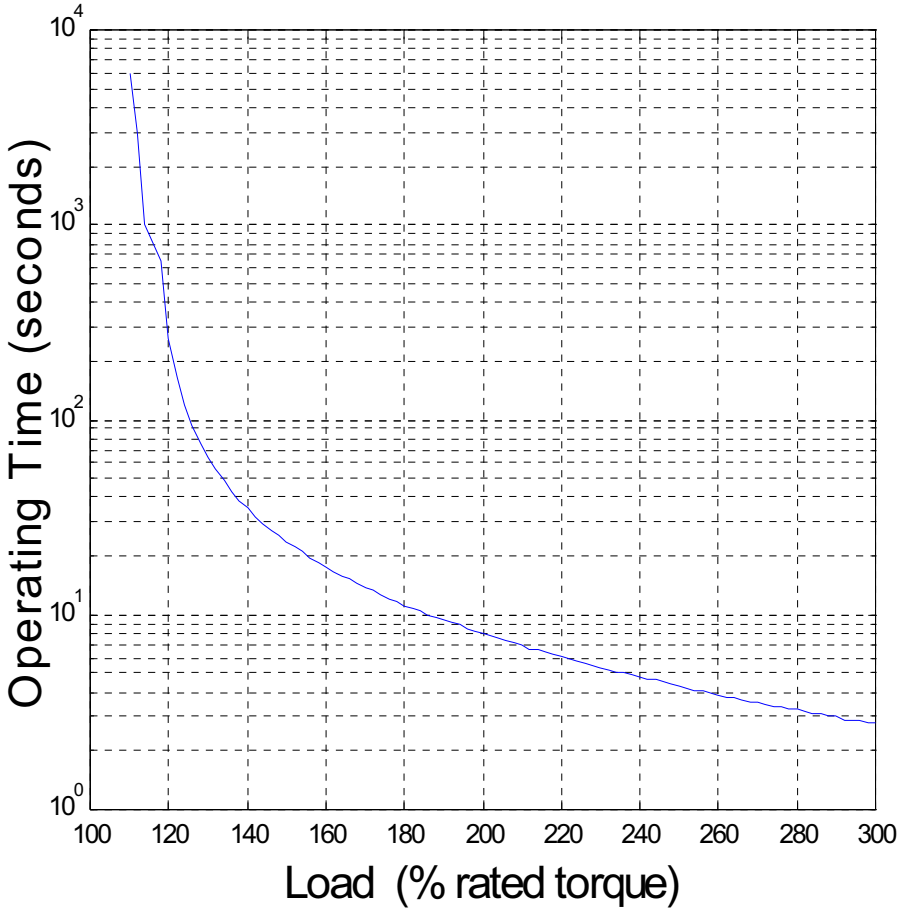
Overload Protection Function

Overload protection is a built-in protective function to prevent a motor from overheating.

Occasion of Overload

1. Motor was operated for several seconds under a torque exceeding 100% torque.
2. Motor had driven high inertia machine and had accelerated and decelerated at high frequency.
3. Motor UVW cable or encoder cable was not connected correctly.
4. Servo gain was not set properly and caused motor hunting.
5. Motor holding brake was not released.

Chart of load and operating time (100W~750W)



Load	Operating Time
120%	263.8s
140%	35.2s
160%	17.6s
180%	11.2s
200%	8s
220%	6.1s
240%	4.8s
260%	3.9s
280%	3.3s
300%	2.8s

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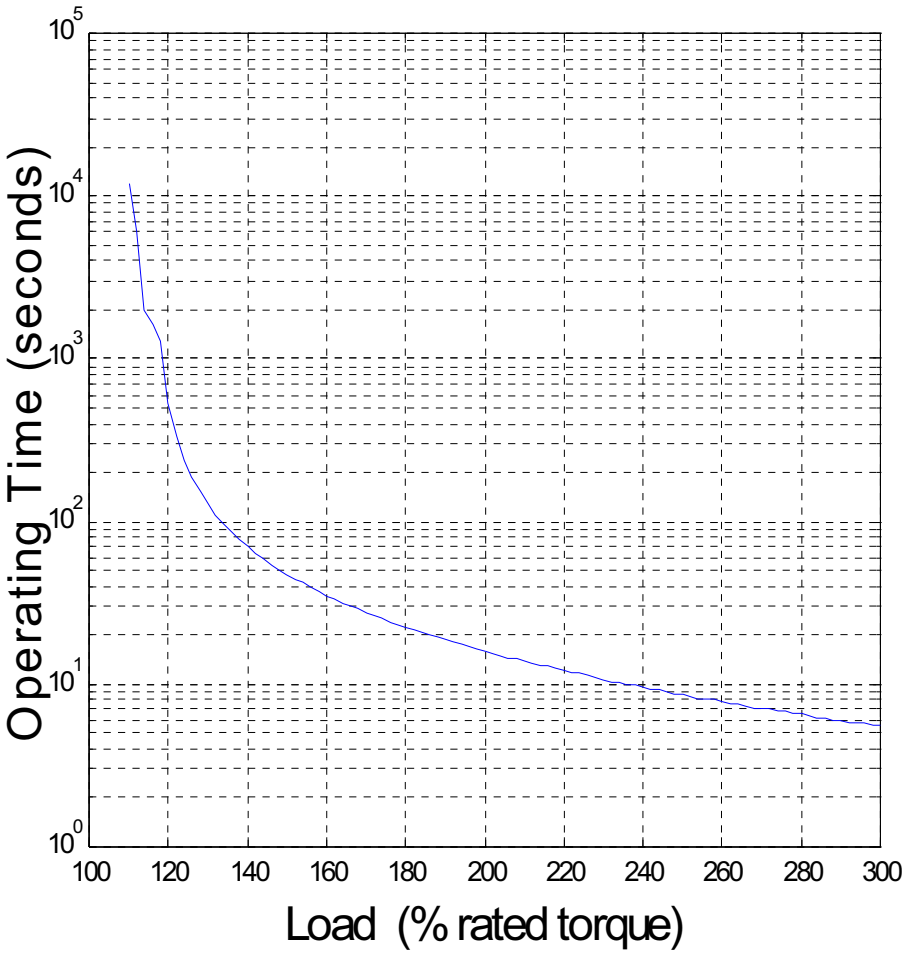
Chart of load and operating time (1kW~3kW)



Load	Operating Time
120%	527.6s
140%	70.4s
160%	35.2s
180%	22.4s
200%	16s
220%	12.2s
240%	9.6s
260%	7.8s
280%	6.6s
300%	5.6s

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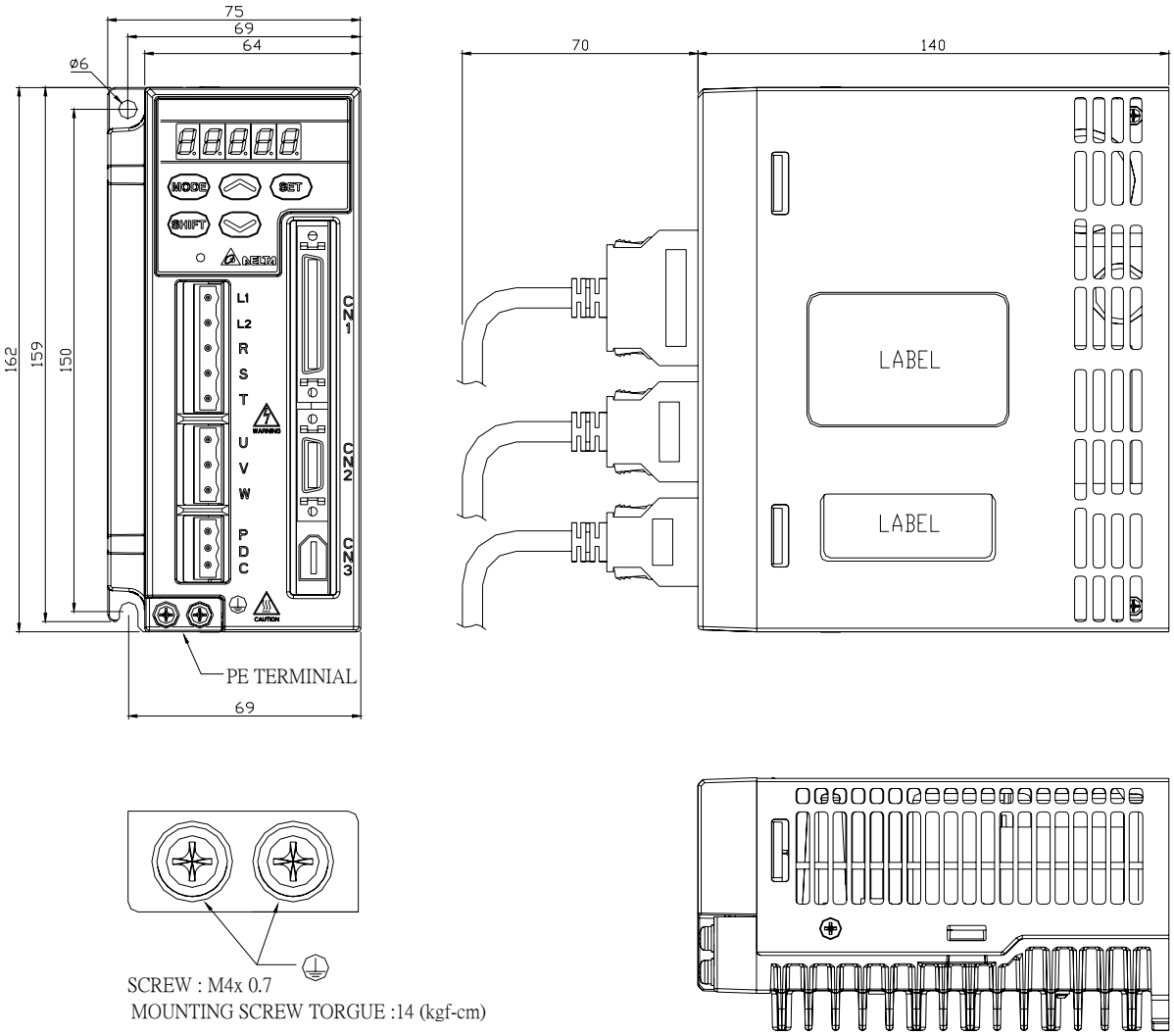
11-6 Dimensions of Servo Drive (Units: mm)

ASD-A0121LA; ASD-A0421LA (100W~400W)



WEIGHT (KG)
1.5

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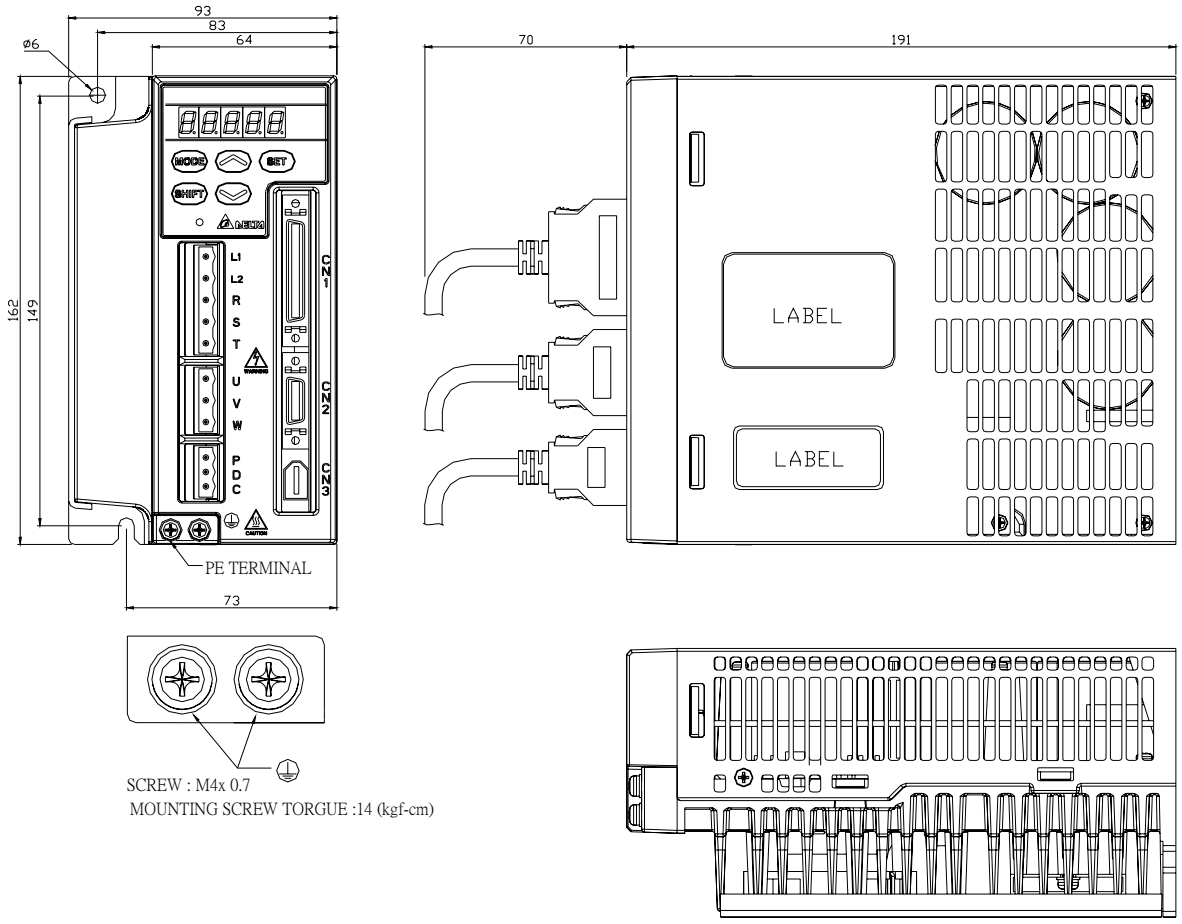
11-6 Dimensions of Servo Drive, cont. (Units: mm)

ASD-A0721LA; ASD-A1021LA; ASD-A1021MA; ASD-A1521MA (750W~1.5kW)



WEIGHT (KG)
2.0

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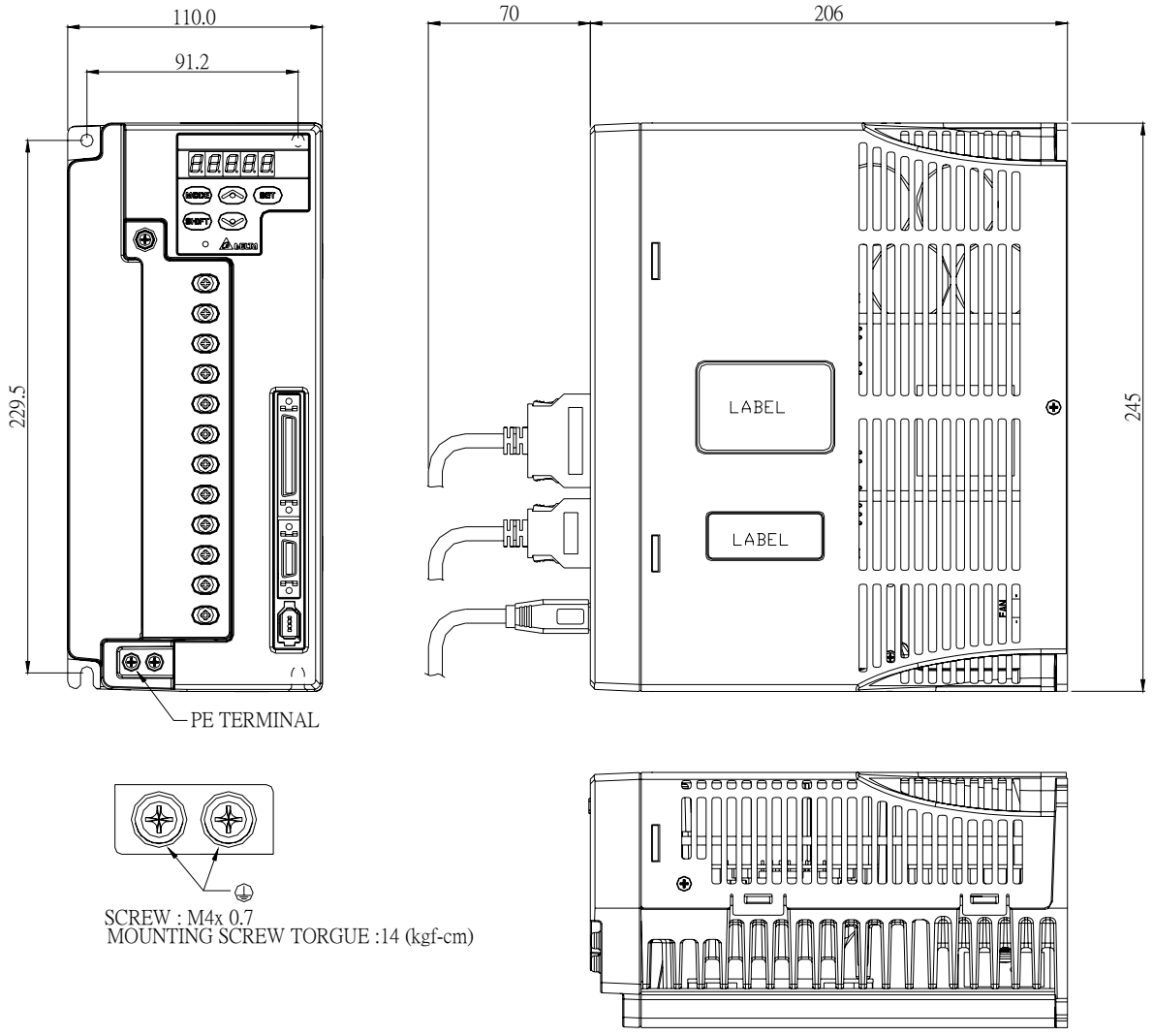
11-6 Dimensions of Servo Drive, cont. (Units: mm)

ASD-A2023LA; ASD-A2023MA; ASD-A3023LA; ASD-A3023MA (2kW~3kW)



WEIGHT (KG)
3.0

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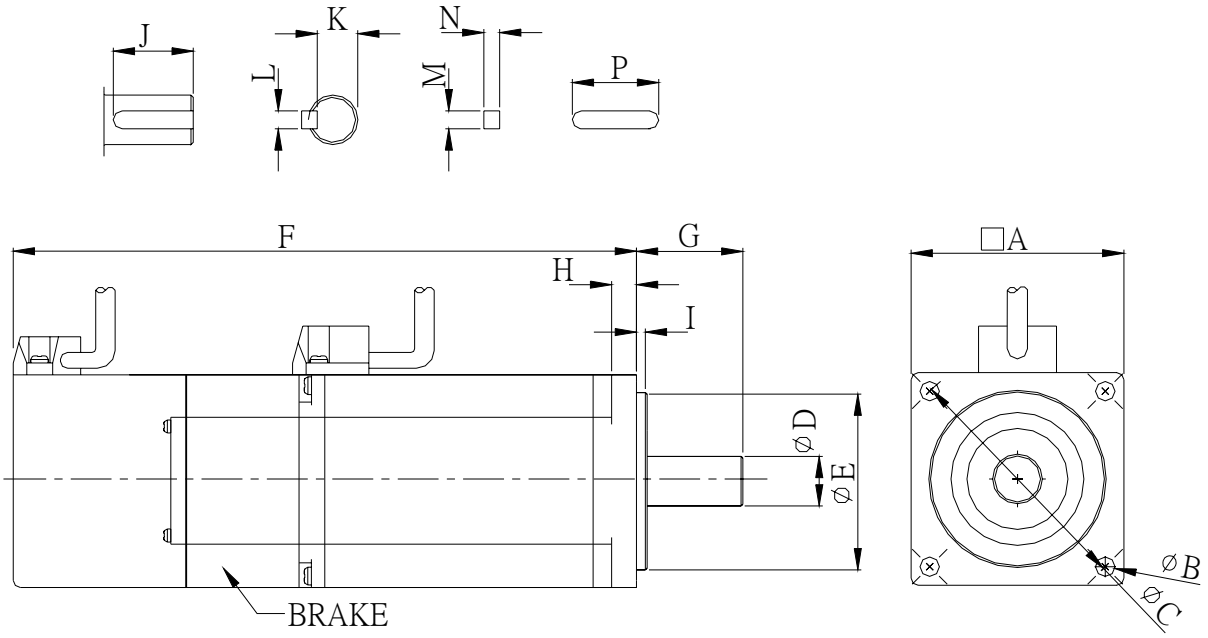
11-7 Dimensions of Low Inertia Servo Motor (Units: mm)



Model	ASMT01L250□□	ASMT02L250□□	ASMT04L250□□	ASMT07L250□□
A	40	60	60	80
B	4.5	5.5	5.5	6.6
C	46	70	70	90
D	8h6 +0.0 -0.009	14h6 +0.0 -0.011	14h6 +0.0 -0.011	19h6 +0.0 -0.013
E	30h7 +0.0 -0.021	50h7 +0.0 -0.025	50h7 +0.0 -0.025	70h7 +0.0 -0.030
F (without brake)	100.1	102.4	124.4	135
F (with brake)	135.7	137	159	171.6
G	25	30	30	35
H	5	6	6	8
I	2.5	3	3	3
J	16	20	20	25
K	9.2 +0.0 -0.2	16 +0.0 -0.2	16 +0.0 -0.2	21.5 +0.0 -0.2
L	3h9 -0.006 -0.031	5h9 -0.012 -0.042	5h9 -0.012 -0.042	6h9 -0.012 -0.042
M	3 +0.0 -0.025	5 +0.0 -0.030	5 +0.0 -0.030	6 +0.0 -0.030
N	3 +0.0 -0.025	5 +0.0 -0.030	5 +0.0 -0.030	6 +0.0 -0.030
P	16 +0.0 -0.18	20 +0.0 -0.21	20 +0.0 -0.21	25 +0.0 -0.21
Weight (without brake)	0.5kg	0.9kg	1.3kg	2.5kg
Weight (with brake)	0.7kg	1.4kg	1.8kg	3.4kg

📖 Note: The boxes (□) at the ends of the model names are for version or options.
(Please refer to Section 1-2 for details about the model explanation)

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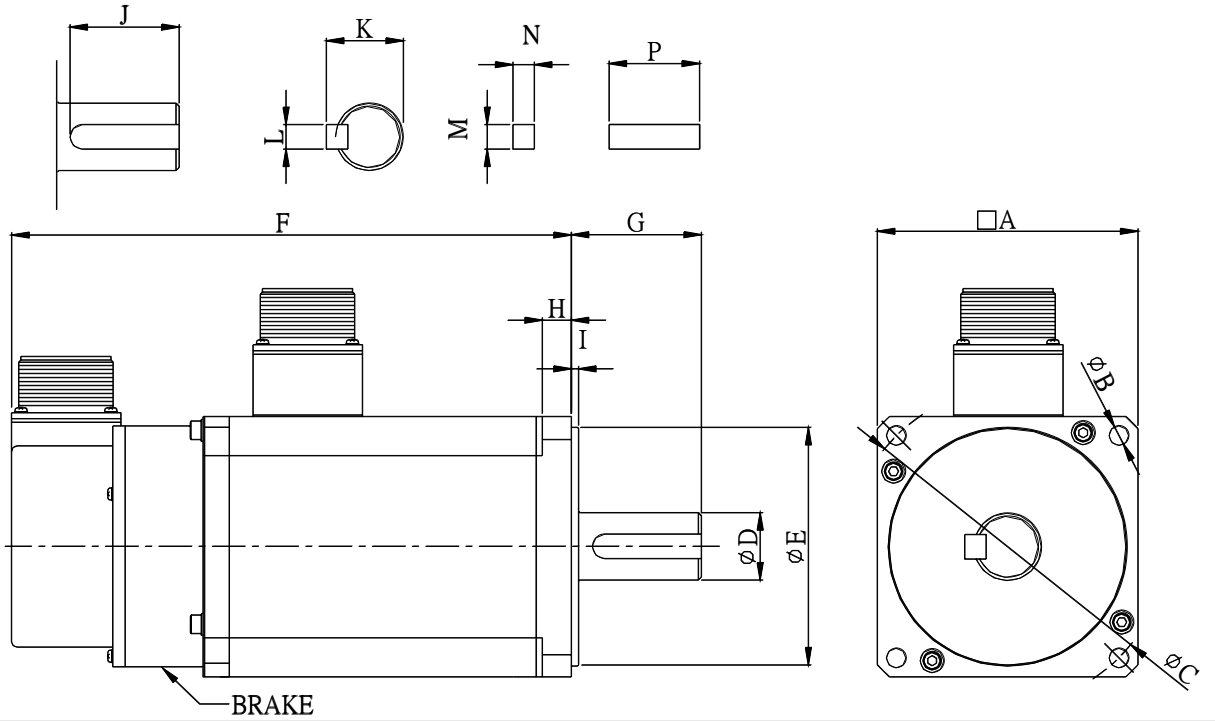
11-7 Dimensions of Low Inertia Servo Motor, cont. (Units: mm)



Model	ASMT10L250□□	ASMT20L250□□	ASMT30L250□□
A	100	100	130
B	9	9	9
C	115 +0.2 -0.2	115 +0.2 -0.2	145 +0.2 -0.2
D	22h6 +0.0 -0.013	22h6 +0.0 -0.013	24h6 +0.0 -0.013
E	95h7 +0.0 -0.035	95h7 +0.0 -0.035	110h7 +0.0 -0.035
F (without brake)	158	194	173
F (with brake)	190	226	211
G	45	55	55
H	17	17	15
I	7	7	4
J	34	44	44
K	25 +0.0 -0.2	25 +0.0 -0.2	27 +0.0 -0.2
L	8h9 +0.0 -0.036	8h9 +0.0 -0.036	8h9 -0.0 -0.036
M	8	8	8
N	7	7	7
P	30	40	40
Weight (without brake)	4.7kg	6.7kg	8.0kg
Weight (with brake)	6.3kg	8.3kg	10.7kg

📖 Note: The boxes (□) at the ends of the model names are for version or options.
(Please refer to Section 1-2 for details about the model explanation)

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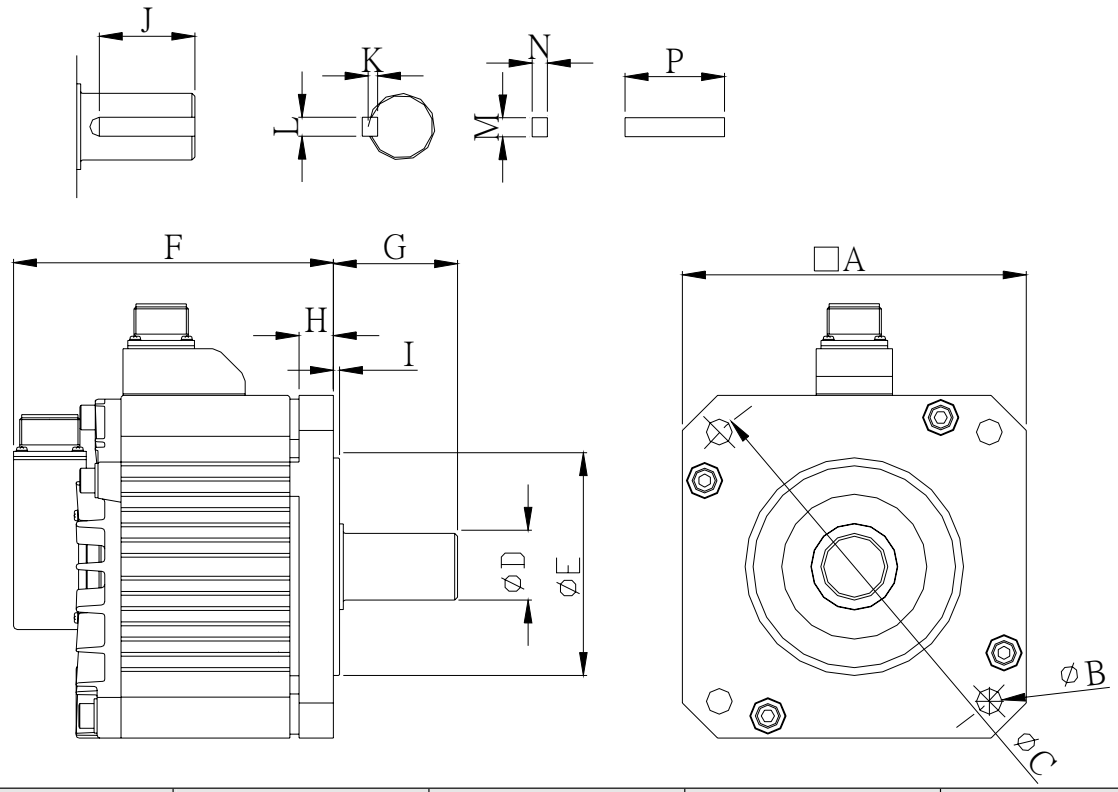
11-8 Dimensions of Medium Inertia Servo Motor (Units: mm)



Model	ASMT10M250□□	ASMT15M250□□	ASMT20M250□□	ASMT30M250□□
A	130	130	180	180
B	9	9	13.5	13.5
C	145 +0.2 -0.2	145 +0.2 -0.2	200 +0.2 -0.2	200 +0.2 -0.2
D	22h6 +0.0 -0.013	22h6 +0.0 -0.013	35h6 +0.0 -0.016	35h6 +0.0 -0.016
E	110h7 +0.0 -0.035	110h7 +0.0 -0.035	114.3h7 +0 -0.035	114.3h7 +0 -0.035
F (without brake)	143	158	164	212
F (with brake)	181	196	213	258
G	55	55	75	75
H	15	15	20	20
I	4	4	4	4
J	44	44	65	65
K	25 +0.0 -0.1	25 +0.0 -0.1	38 +0.0 -0.2	38 +0.0 -0.2
L	8h9 +0.0 -0.036	8h9 +0.0 -0.036	10h9 +0.0 -0.036	10h9 +0.0 -0.036
M	8	8	10	10
N	7	7	8	8
P	40	40	60	60
Weight (without brake)	4.8kg	7.0kg	12.0kg	17.0kg
Weight (with brake)	7.5kg	9.7kg	19.0kg	24.0kg

📖 Note: The boxes (□) at the ends of the model names are for version or options.
(Please refer to Section 1-2 for details about the model explanation)

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11-9 EMI Filters Selection

Item	Power	Servo Drive Model	EMI Filter Model
1	100W	ASD-A0121LA	16DRT1W3S (1-phase)
			10TDT1W4C (3-phase)
2	200W	ASD-A0221LA	16DRT1W3S (1-phase)
			10TDT1W4C (3-phase)
3	400W	ASD-A0421LA	16DRT1W3S (1-phase)
			10TDT1W4C (3-phase)
4	750W	ASD-A0721LA	16DRT1W3S (1-phase)
			10TDT1W4C (3-phase)
5	1000W	ASD-A1021LA	16DRT1W3S (1-phase)
			10TDT1W4C (3-phase)
6	1500W	ASD-A1521MA	16DRT1W3S (1-phase)
			10TDT1W4C (3-phase)
7	2000W	ASD-A2023LA	26TDT1W4C (3-phase)
8	2000W	ASD-A2023MA	26TDT1W4C (3-phase)
9	3000W	ASD-A3023LA	26TDT1W4C (3-phase)
10	3000W	ASD-A3023MA	26TDT1W4C (3-phase)

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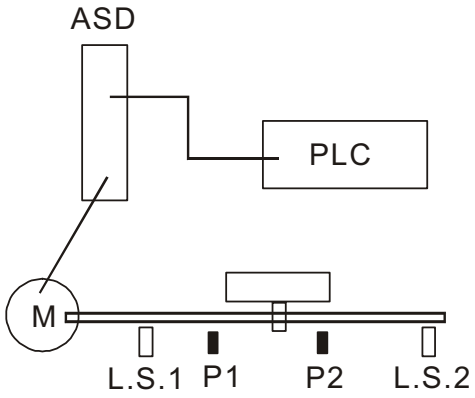
Chapter 12 Application Examples

12-1 Position Control (including homing function)

Suppose that the machine will move to limit switch (CCWL), L.S.1 when motor is in forward rotation (from motor shaft view) and the machine will move to limit switch (CWL), L.S.2 when motor is in reverse rotation, if limit switch is set, L.S.1 as “Home”, the machine will be positioned between P1 and P2 according to working procedure.



Parameters Setting

- P1-01=1 (Position control (Pr) mode setting)
- P1-47=100 (Activate forward homing)
- P2-15=022 (Reverse inhibit limit (CWL). Then, connect contact “b” of L.S.1 to DI6)
- P2-16=023 (Forward inhibit limit (CCWL). Then, connect contact "b” of L.S.2 to DI7)
- P2-10=101 (Servo On (SON), default: DI1)
- P2-11=108 (Command triggered (CTRG), default: DI2)
- P2-12=111 (Position command selection (POS0), default: DI3)
- P1-33=0 (Absolute position command)
- Set P1-15, P1-16 as position P1 (Internal position command 1)
- Set P1-17, P1-18 as position P2 (Internal position command 2)
- P2-18=101 (Servo ready (SRDY), default: DO1)
- P2-21=105 (Positioning completed (TPOS), default: DO4)
- P2-20=109 (Home completed (HOME), default: DO3)
- P1-50=0, P1-51=0 (Homing offset rotation / pulse number)
- Other relevant parameters: P1-34, P1-35, P1-36 (Acceleration/Deceleration time setting); P1-48, P1-49 (Speed setting of high/low speed Homing)

Operation

- Re-start the power to be ON again.
- After Servo ready is completed, activate the drive to be Servo ON. Then, the system will automatically complete home operation.

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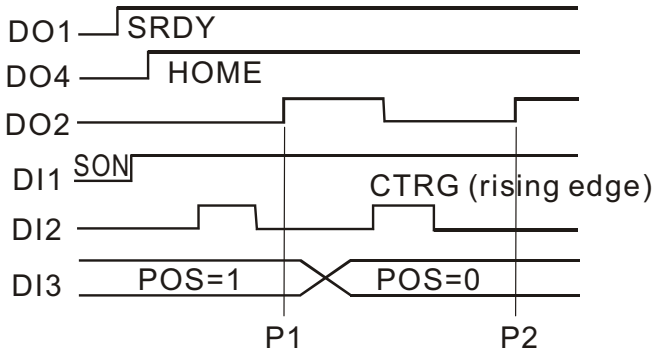
- When home operation is completed (Home ready), then can perform the position control function.



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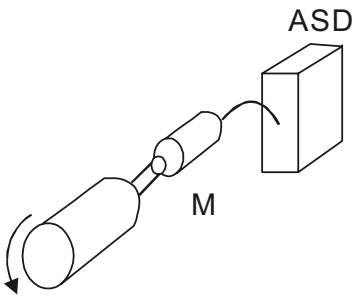
12-2 Roller Feeding

Suppose that the motor rotate 1/4 rev. while it is triggered every time (10000/4=2500Pulse).

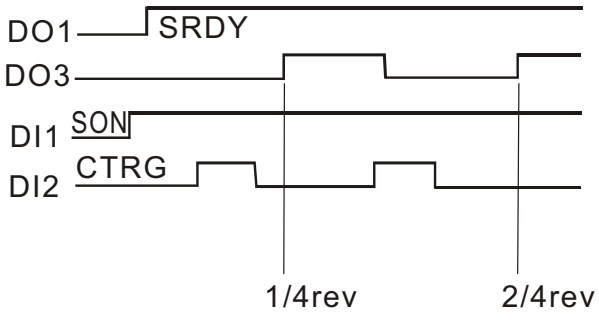


Parameters Setting

- P1-01=1 (Position control (Pr) mode setting)
- P2-10=101 (Servo On (SON), default: DI1)
- P2-11=108 (Command triggered (CTRG), default: DI2)
- P1-15=0 (Position rotation number is 0(zero))
- P1-16=2500 (Position rotation pulse number)
- P1-33=1 (Incremental position command)
- P2-18=101 (Servo ready (SRDY), default: DO1)
- P2-21=105 (Positioning completed (TPOS), default: DO4)
- Other relevant parameters: P1-34, P1-35, P1-36 (Acceleration/Deceleration time setting)

Operation

- Re-start the power to be ON again.
- After Servo ready is completed, press the Servo ON key and activate the drive to be Servo ON.
- After DI2 is triggered, the motor will rotate 1/4rev automatically.



12-3 Connecting to Delta DVP-EH Series PLC

Delta servo drives can be connected to Delta DVP-EH series PLC and provide functions including: home, JOG operation, acceleration/deceleration setting, relative position control, absolute position control and pulse numbers monitor.

Parameters Setting

- P1-00=2 (Input type setting of external pulse, 2: pulse input + direction)
- P1-01=0 (Position control (Pt) mode setting)
- P2-10=101 (Servo On (SON), default: DI1)
- P2-11=104 (Pulse count clear function, contact: DI2)
- P2-15=102(Fault reset, contact: DI5)
- Other relevant parameters: P1-34, P1-35, P1-36 (Acceleration/Deceleration time setting)

Operation

- Re-start the power to be ON again.
- After Servo ready is completed, activate the drive to be Servo ON.
- Connect contact X1 of PLC (drive X1 to be ON) to perform home operation. When contact X10 is ON, home operation is completed.
- PLC X2 : JOG forward operation ; PLC X3 : JOG reverse operation.
- After home operation is completed, connect contact X5 of PLC (drive X5 to be ON) and the absolute coordinate position will be 10000. Then, connect contact X4 of PLC (drive X4 to be ON) and the absolute coordinate position will be 0.
- Repeat this position control operation.

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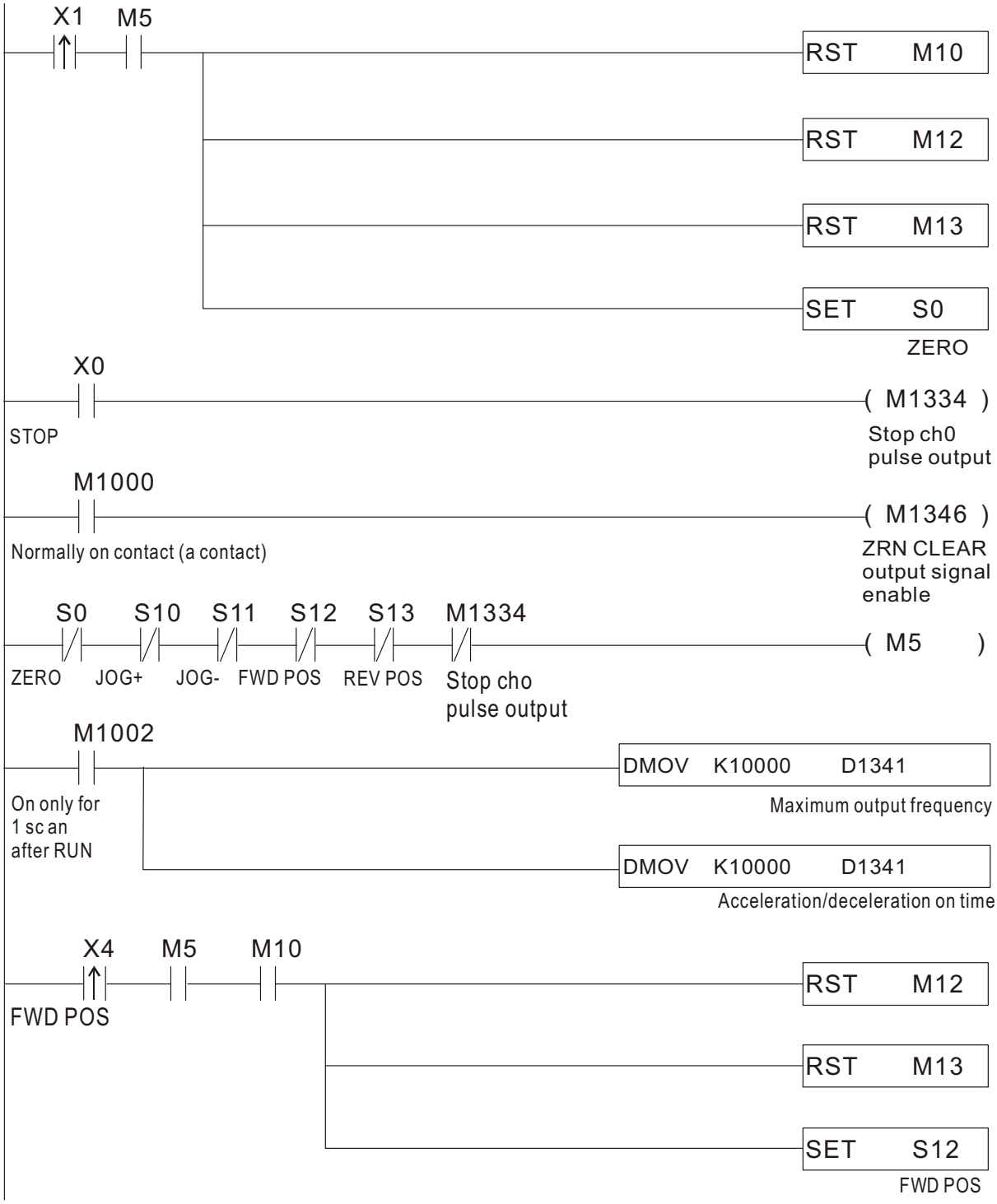
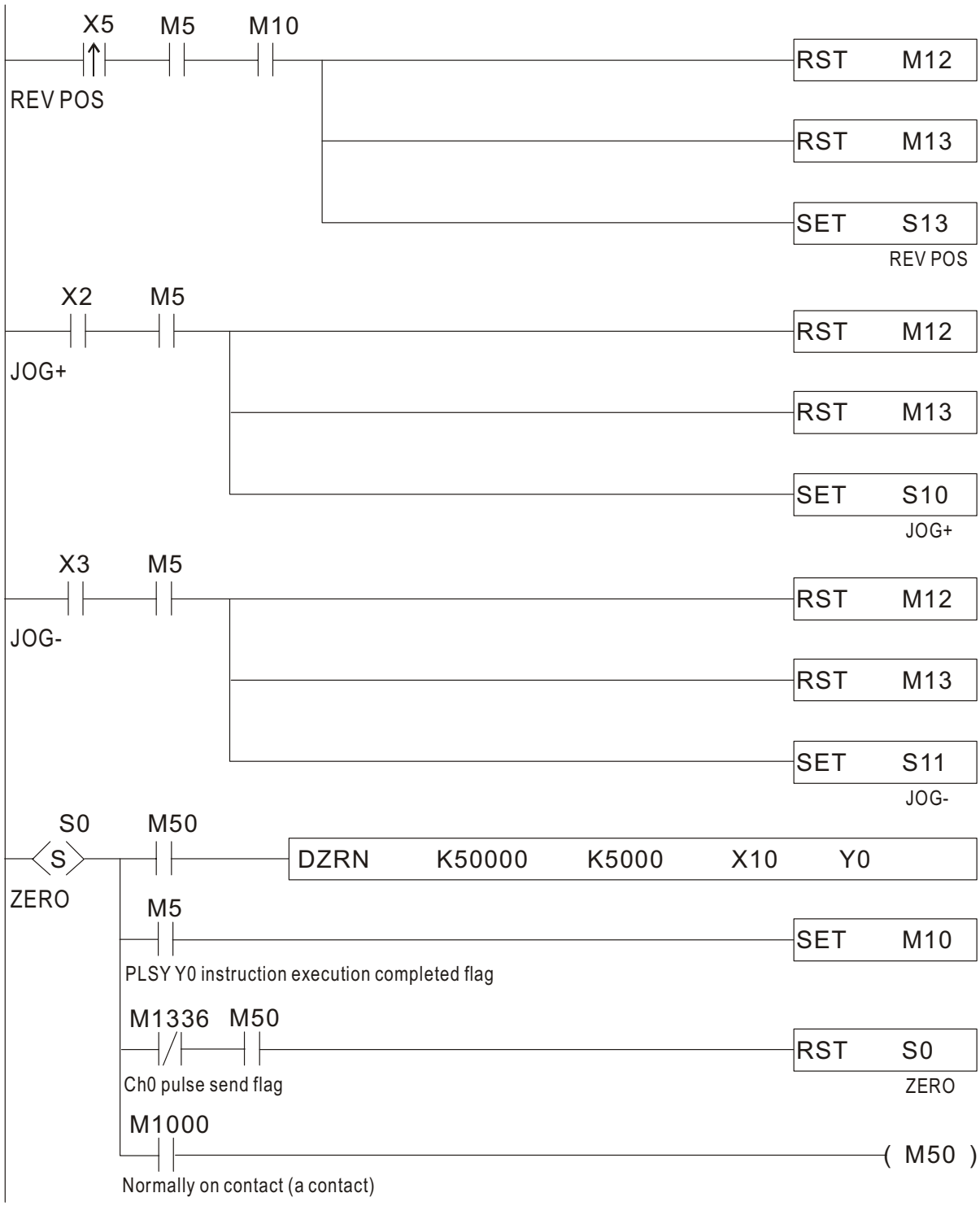

X1
M5
RST M10
RST M12
RST M13
SET S0
ZERO
X0
(M1334)
STOP
Stop ch0
pulse output
M1000
(M1346)
Normally on contact (a contact)
ZRN CLEAR
output signal
enable
S0
S10
S11
S12
S13
M1334
(M5)
ZERO
JOG+
JOG-
FWD POS
REV POS
Stop cho
pulse output
M1002
DMOV K10000 D1341
On only for
1 sc an
after RUN
Maximum output frequency
DMOV K10000 D1341
Acceleration/deceleration on time
X4
M5
M10
RST M12
RST M13
SET S12
FWD POS
FWD POS



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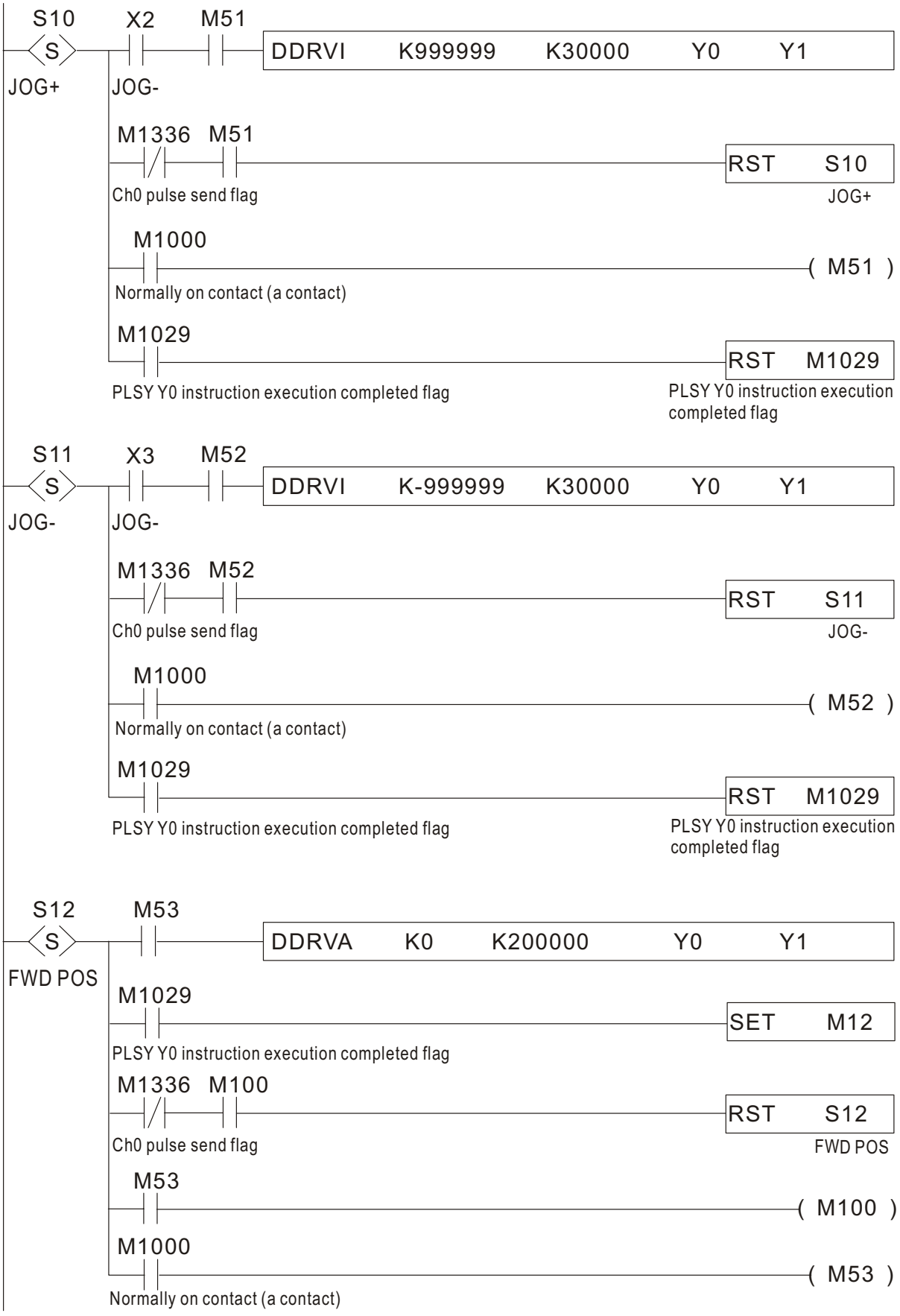

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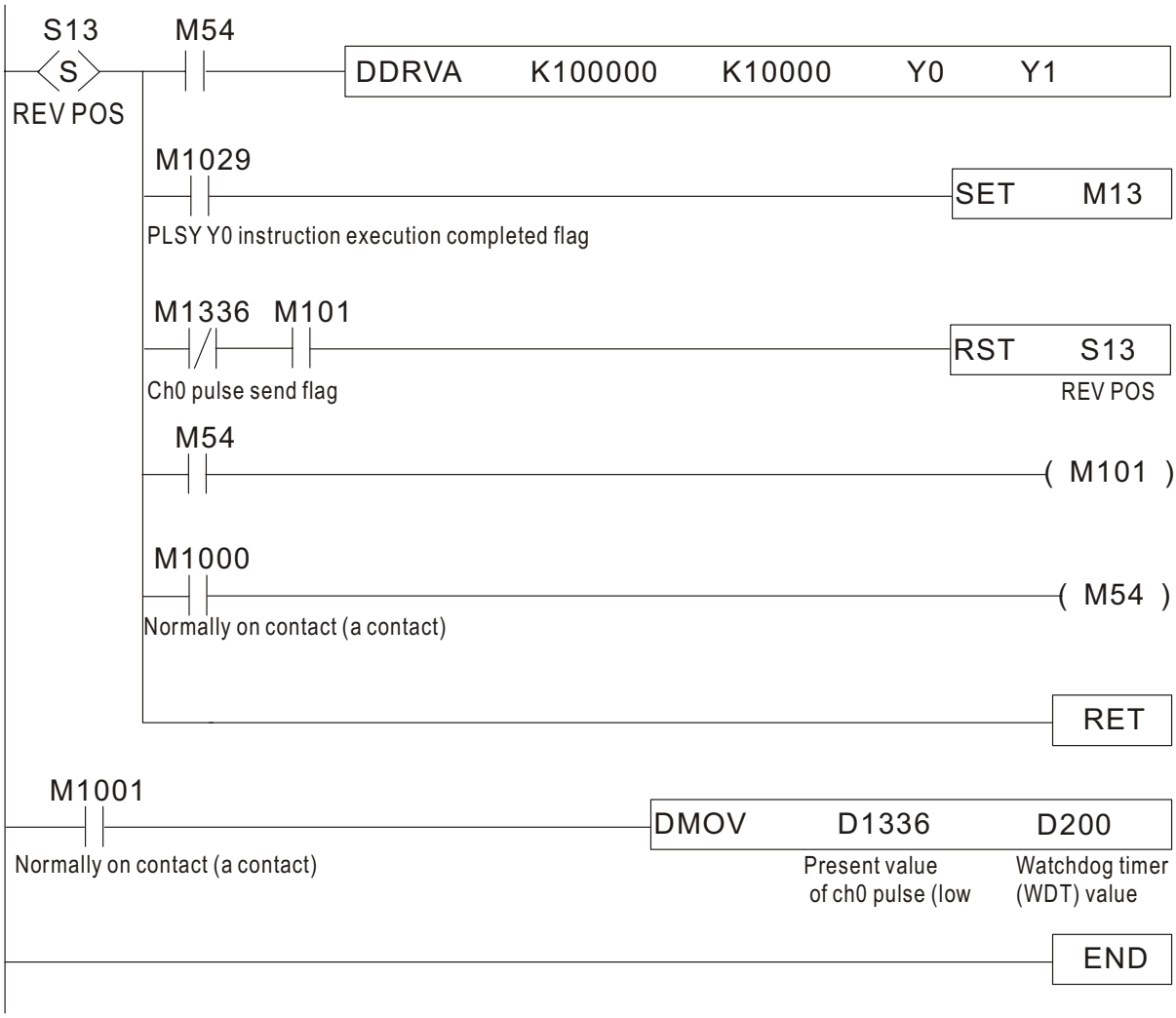

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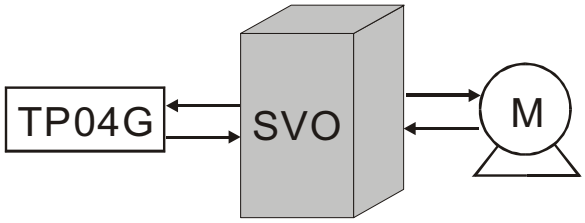
12-4 Connecting to Delta TP04 Series

Delta servo drives can be connected to Delta TP04 Series Operation Interface Panel and provide functions including: Home, JOG operation, Position learning function, Relative position control, Absolute position control, Monitor and parameter settings.

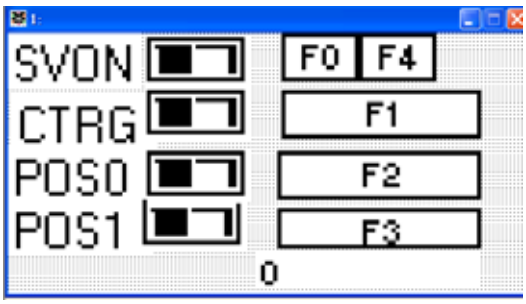


Parameters Setting

- P1-01=1 (Position control (Pr) mode setting)
- P1-47=202 (SHOM drive ORGP to perform forward homing)
- P2-15=124 (Home detection position, contact: DI6)
- P2-16=127 (Activate signal of home, contact: DI7)
- P2-10=101 (Servo On (SON), default: DI1)
- P2-11=108 (Command triggered (CTRG), default: DI2)
- P2-12=111 (Position command selection (POS0), default: DI3)
- P2-13=112 (Position command selection (POS1), default: DI4)
- P3-02=1 (Communication protocol 7,E,1)
- P3-05=2 (RS-485 serial communication)

Operation

- Re-start the power to be ON again.
- After Servo ready is completed, press the Servo ON key and activate the drive to be Servo ON.



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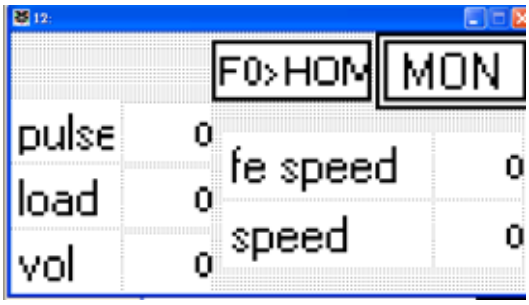

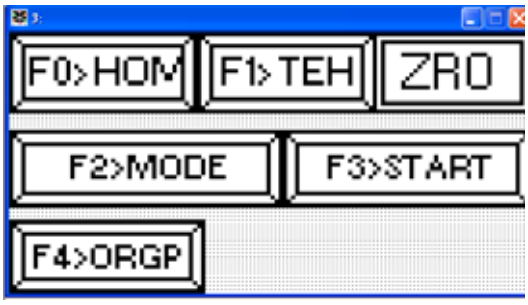

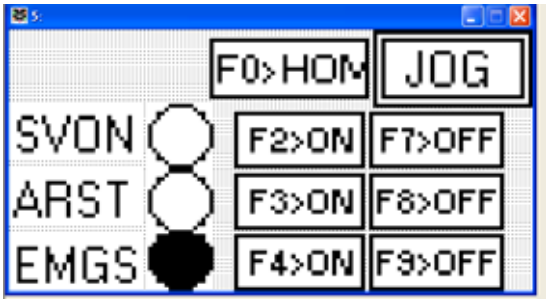

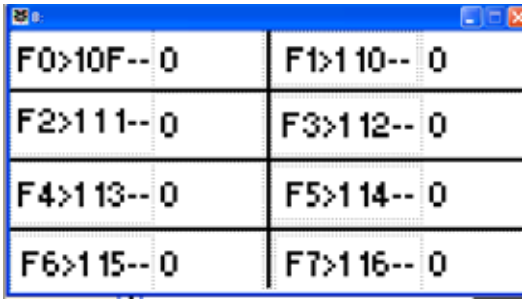

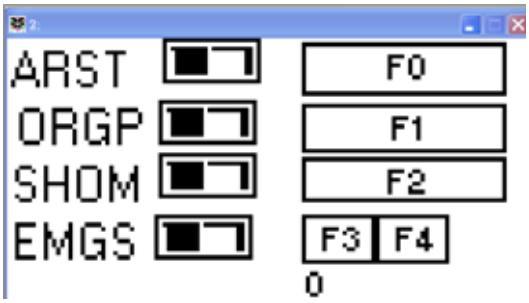

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12-5 Position Control Mode (Pr Mode)

■ Relevant Parameters Description

Parameter	Communication Address	Parameter Description
P1-01	0101H	Control Mode and Output Direction 001: Forward torque in Pr mode 101: Reverse torque in Pr mode
P1-33	0121H	Position Control Mode (Pr) 0: Absolute position command 1: Incremental position command
P1-34	0122H	Acceleration Time 1st to 3rd step Acceleration time (When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled)
P1-35	0123H	Deceleration Time 1st to 3rd step Deceleration time (When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled)
P1-36	0124H	Accel /Decel S-curve When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled.
P1-44	012CH	Electronic Gear Ratio (1st Numerator) (N1) If the electronic gear deceleration ratio is 1/75, set numerator to 75
P1-45	012DH	Electronic Gear Ratio (Denominator)
P1-47	012FH	Homing Mode 202: When (MD1, MD0)=(OFF, ON), Forward Homing 203: When (MD1, MD0)=(OFF, ON), Reverse Homing
P1-50	0132H	Homing Offset Rotation Number
P1-51	0133H	Homing Offset Pulse Number Total homing offset pulse number =P1-50 x 10000 + P1-51

The following table indicates the position command registers and the corresponding moving speed registers.

Positioning Point	Position Command Register	Moving Speed Register
P1	(P1-15, P1-16)	P2-36 (V1)
P2	(P1-17, P1-18)	P2-37 (V2)
P3	(P1-19, P1-20)	P2-38 (V3)
P4	(P1-21, P1-22)	P2-39 (V4)
P5	(P1-23, P1-24)	P2-40 (V5)
P6	(P1-25, P1-26)	P2-41 (V6)
P7	(P1-27, P1-28)	P2-42 (V7)
P8	(P1-29, P1-30)	P2-43 (V8)

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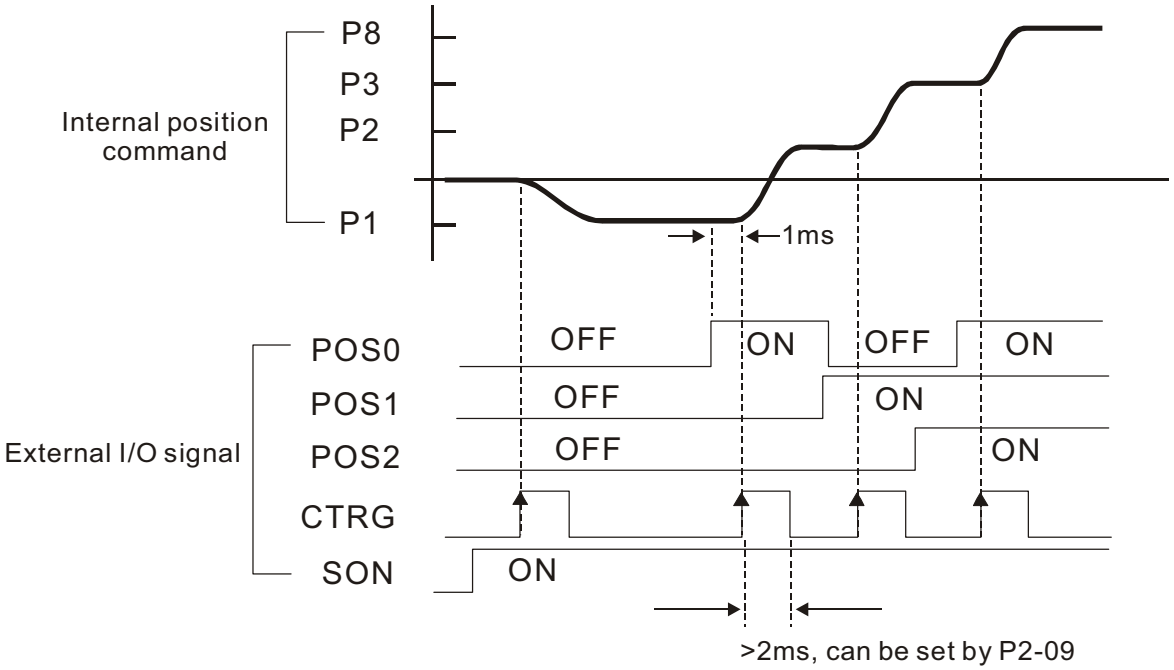
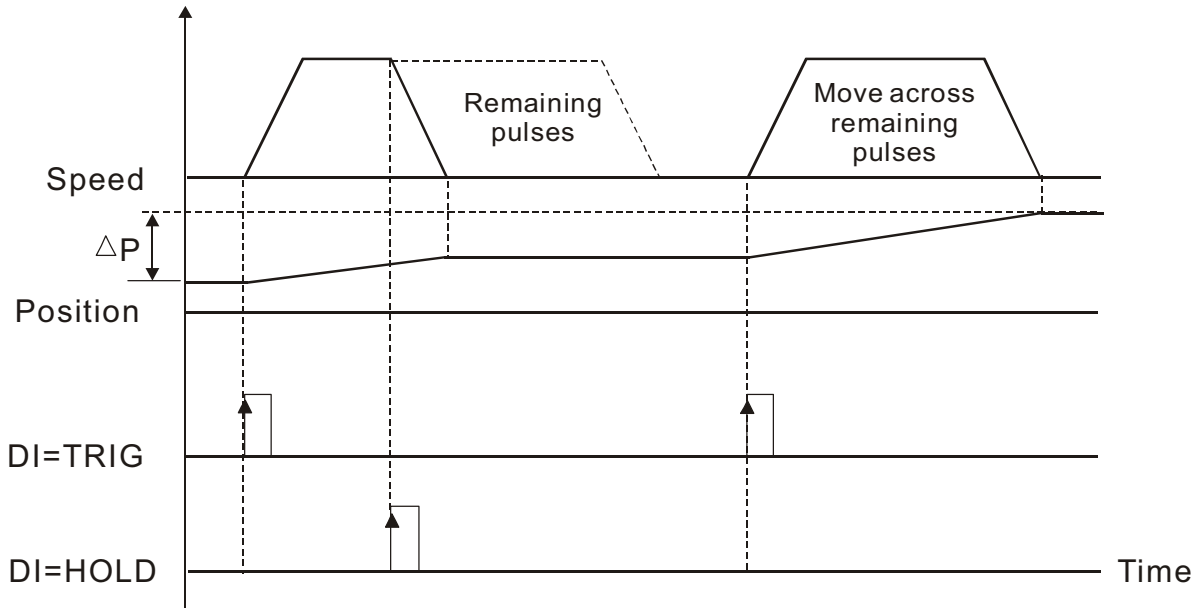
■ Trigger Timing Charts

(1) Timing Chart of Internal Position Register Selection



(2) HOLD Timing Chart:

If HOLD signal is ON when position moving, the motor will decelerate and stop according to the deceleration time which is set by parameter P1-34 ~ P1-36. When TRIG signal is ON again, the motor will continue to move across the remaining pulses. Then, reach the target position that is set last time.



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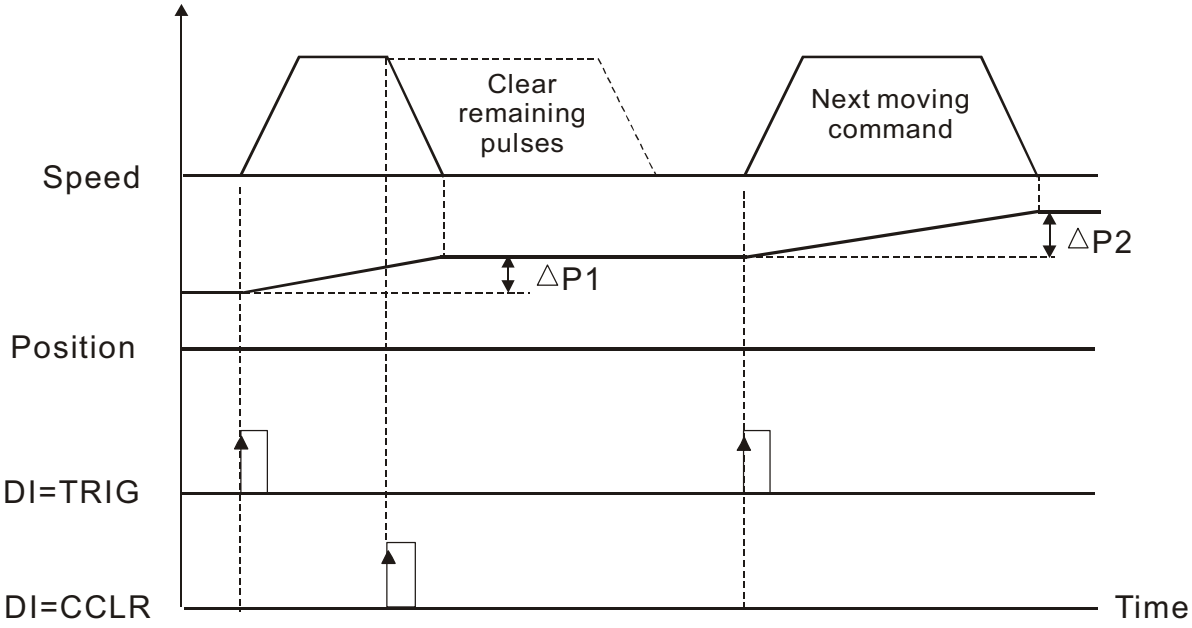
(3) Command Abort Timing Chart:

To use command abort function, set parameter P2-50 to 2. At this time, if CCLR signal is ON when position moving, the motor will decelerate and stop according to the deceleration time which is set by parameter P1-34 ~ P1-36 and the remaining pulses will be aborted. When TRIG signal is ON again, the motor will continue to move forward and reach the target position that is set currently.



12-6 Feed Step Control

■ Relevant Parameters Description

Parameter	Communication Address	Parameter Description
P1-01	0101H	Control Mode and Output Direction 001: Forward torque in Pr mode 101: Reverse torque in Pr mode
P1-12	010CH	Torque Limit Setting Torque decrease value is represented by a percentage of rated torque.
P1-33	0121H	Position Control Mode (Pr) 2: Forward operation search feed step 3: Reverse operation search feed step 4: Short-pass search feed step
P1-34	0122H	Acceleration Time 1st to 3rd step Acceleration time (When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled)
P1-35	0123H	Deceleration Time 1st to 3rd step Deceleration time (When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled)
P1-36	0124H	Accel /Decel S-curve When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled.
P1-44	012CH	Electronic Gear Ratio (1st Numerator) (N1) If the electronic gear deceleration ratio is 1/75, set numerator to 75
P1-45	012DH	Electronic Gear Ratio (Denominator)
P1-47	012FH	Homing Mode 202: When (MD1, MD0)=(OFF, ON), Forward Homing 203: When (MD1, MD0)=(OFF, ON), Reverse Homing
P1-50	0132H	Homing Offset Rotation Number
P1-51	0133H	Homing Offset Pulse Number Total homing offset pulse number =P1-50 x 10000 + P1-51
P1-55	0137H	Maximum Speed Limit
P2-36	0224H	Moving Speed Setting of 1st Position Maximum feed step speed (When speed is above 3000rpm, please set P1-55 to a proper value)
P2-44	022CH	Digital Output Mode Setting 0: General output mode 1: Combination output mode

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■ Relevant Parameters Description, cont.

Parameter	Communication Address	Parameter Description
P2-45	022DH	Combination Output Signal Delay Time [UNIT: 4msec] Output signal will hold delay time when position command is completed.
P2-46	022EH	Feed Step Number Range: 2~32
P2-47	022FH	Position Deviation Clear Delay Time [UNIT: 20msec] This function is disabled when its setting value is set to 0.
P2-51	0233H	Internal Servo ON setting

■ Digital I/O Signal Setting

DI Signal	Parameter Setting	Explanation
DI1 (INDEX0)	P2-10 = 128	Feed step selection input 0
DI2 (INDEX1)	P2-11 = 129	Feed step selection input 1
DI3 (INDEX2)	P2-12 = 130	Feed step selection input 2
DI4 (INDEX3)	P2-13 = 131	Feed step selection input 3
DI5 (ORGP)	P2-14 = 124	Reference “Home” sensor
DI6 (SON)	P2-15 = 101	Servo ON (when the setting value is 137, it is manual operation function.)
(MDP0)	P2-15 = 35 (contact “b”)	Manually continuous operation
(MDP1)	P2-15 = 36 (contact “b”)	Manually single step operation
DI7 (MD0)	P2-16 = 33 (contact “b”)	Feed step mode input 0
DI8 (MD1)	P2-17 = 34 (contact “b”)	Feed step mode input 1

DO Signal	Parameter Setting	Explanation
DO1	P2-18 = 101	Please refer to “Definition of DO Signals” in the following section.
DO2	P2-19 = 103	
DO3	P2-20 = 109	
DO4	P2-21 = 105	
DO5	P2-22 = 107	

🕮 **Note:** Please set parameter P2-08 to 12 before changing the setting value of DI and DO signals.

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■ Mode Functions

MDP0, MDP1	Status	MD1	MD0	Explanation
OFF	1	OFF	OFF	Torque decrease
	2	OFF	ON	Feed step position mode
	3	ON	OFF	Homing mode
	4	ON	ON	Emergency stop
ON	-	-	-	Don't care
	-	OFF	ON	CW manual operation
	-	ON	OFF	CCW manual operation
	-	-	-	Don't care

🕮 **Note:**

1. The emergency stop warning message will appear if MD0 and MD1 are ON after power suppliers to AC servo drive. If turn MD0 and MD1 to be OFF, the emergency stop warning message will disappear automatically.
2. When the status is switched from 2 (MD1=OFF, MD0=ON) to 3 (MD1=ON, MD0=OFF), the emergency stop warning message will appear. On the other hand, the emergency stop warning message will also appear when the status is switched from 3 to 2. Therefore, no matter what status you want to switch to, it is needed to switch to status 1 first to perform torque decrease (for example, switch from 2 →1→3 or 3→1→2).
3. Ensure that MD0 and MD1 are set to ON state to enforce an emergency stop.

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■ Definitions of INDEX0~4

(ON=1, OFF=0)

Nr.	INDEX4	INDEX3	INDEX2	INDEX1	INDEX0	INDEX NUMBER
1	0	0	0	0	0	INDEX 1
2	0	0	0	0	1	INDEX 2
3	0	0	0	1	0	INDEX 3
4	0	0	0	1	1	INDEX 4
5	0	0	1	0	0	INDEX 5
6	0	0	1	0	1	INDEX 6
7	0	0	1	1	0	INDEX 7
8	0	0	1	1	1	INDEX 8
9	0	1	0	0	0	INDEX 9
10	0	1	0	0	1	INDEX 10
11	0	1	0	1	0	INDEX 11
12	0	1	0	1	1	INDEX 12
13	0	1	1	0	0	INDEX 13
14	0	1	1	0	1	INDEX 14
15	0	1	1	1	0	INDEX 15
16	0	1	1	1	1	INDEX 16
17	1	0	0	0	0	INDEX 17
18	1	0	0	0	1	INDEX 18
19	1	0	0	1	0	INDEX 19
20	1	0	0	1	1	INDEX 20
21	1	0	1	0	0	INDEX 21
22	1	0	1	0	1	INDEX 22
23	1	0	1	1	0	INDEX 23
24	1	0	1	1	1	INDEX 24
25	1	1	0	0	0	INDEX 25
26	1	1	0	0	1	INDEX 26
27	1	1	0	1	0	INDEX 27

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■ Definitions of DO Signals

(ON=1, OFF=0)

Nr.	DO5	DO4	DO3	DO2	D01	Description
1	0	0	0	0	0	ALRAM
2	0	0	0	0	1	SERVO READY
3	0	0	0	1	0	HOMING (under operation)
4	0	0	0	1	1	HOME Completed
5	0	0	1	0	0	CHANGE INDEX (under operation)
6	0	0	1	0	1	INDEX 1 (In position)
7	0	0	1	1	0	INDEX 2 (In position)
8	0	0	1	1	1	INDEX 3 (In position)
9	0	1	0	0	0	INDEX 4 (In position)
10	0	1	0	0	1	INDEX 5 (In position)
11	0	1	0	1	0	INDEX 6 (In position)
12	0	1	0	1	1	INDEX 7 (In position)
13	0	1	1	0	0	INDEX 8 (In position)
14	0	1	1	0	1	INDEX 9 (In position)
15	0	1	1	1	0	INDEX 10 (In position)
16	0	1	1	1	1	INDEX 11 (In position)
17	1	0	0	0	0	INDEX 12 (In position)
18	1	0	0	0	1	INDEX 13 (In position)
19	1	0	0	1	0	INDEX 14 (In position)
20	1	0	0	1	1	INDEX 15 (In position)
21	1	0	1	0	0	INDEX 16 (In position)
22	1	0	1	0	1	INDEX 17 (In position)
23	1	0	1	1	0	INDEX 18 (In position)
24	1	0	1	1	1	INDEX 19 (In position)
25	1	1	0	0	0	INDEX 20 (In position)
26	1	1	0	0	1	INDEX 21 (In position)
27	1	1	0	1	0	INDEX 22 (In position)
28	1	1	0	1	1	INDEX 23 (In position)
29	1	1	1	0	0	INDEX 24 (In position)
30	1	1	1	0	1	INDEX 25 (In position)
31	1	1	1	1	0	INDEX 26 (In position)
32	1	1	1	1	1	INDEX 27 (In position)

Note:

1. When alarm occurs, DO=0 (all OFF)
2. When the servo drive is ready, DO=1
3. When return back to “Home” (Homing), DO=2
4. When returning back to “Home” is completed, DO=3

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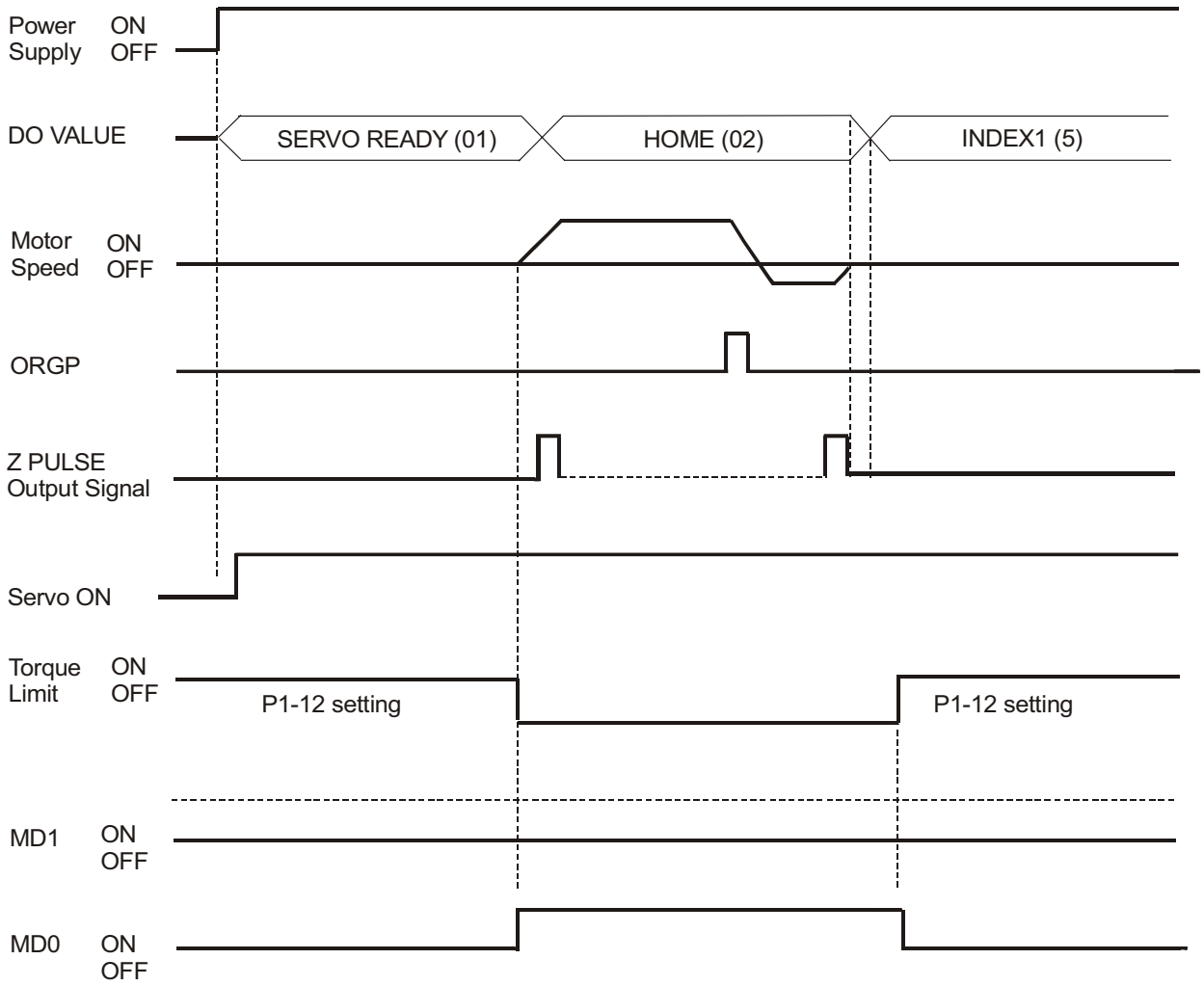
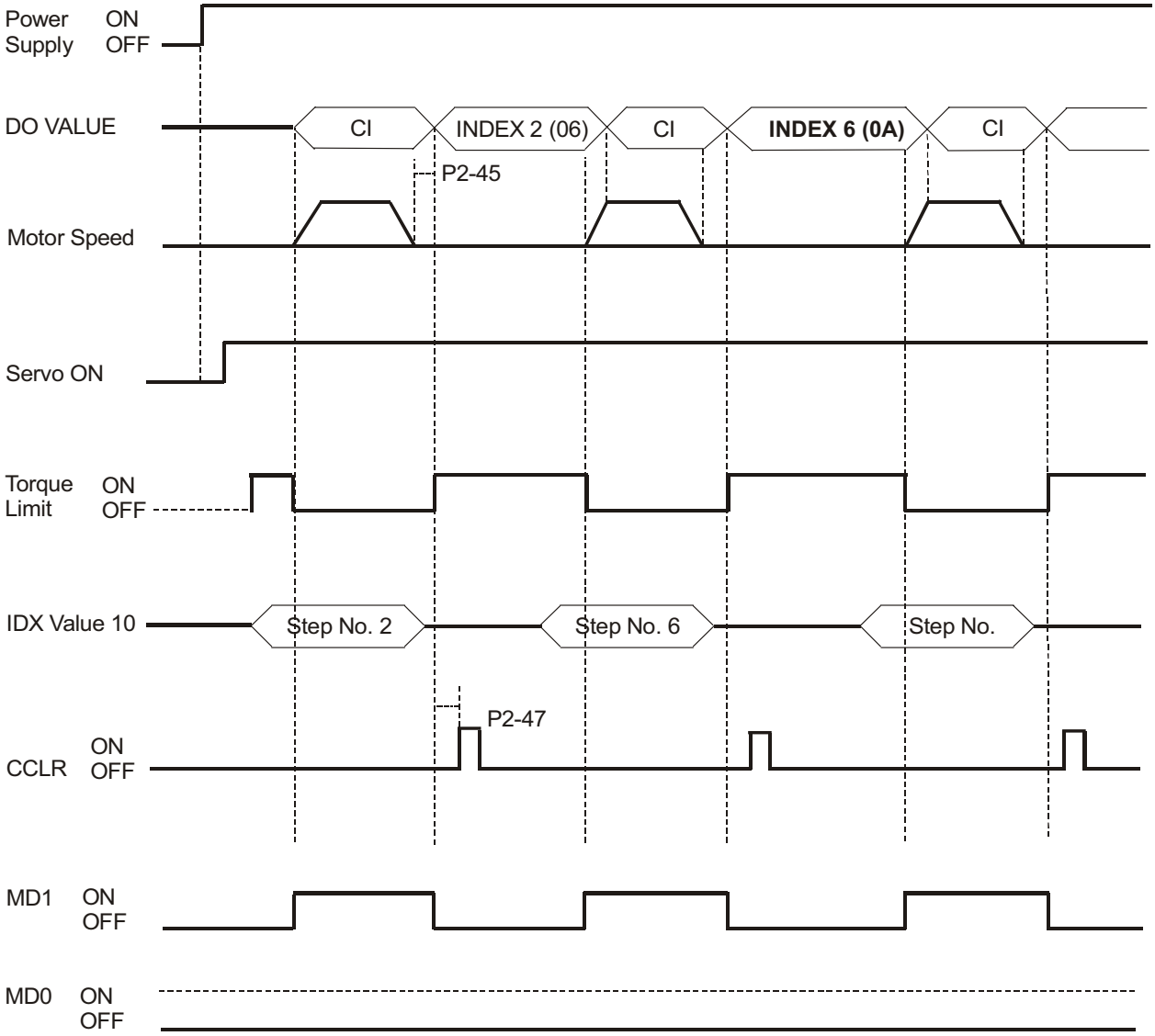
5. When feed step function is undergoing, DO=4
6. When feed step function is completed (In position), the corresponding INDEX NUMBER will display, and DO=nn
7. Feed step output position = DO value - 4 (Example: if DO=7, the feed step output position =7 - 4 = 3)
8. When returning to HOME, if DO=1 (SERVO READY) after any abnormal conditions are removed, it is needed to return to HOME again to ensure that the “Home” is correct.

■ Timing charts of DI/DO Signals Operation

(1) Homing Mode

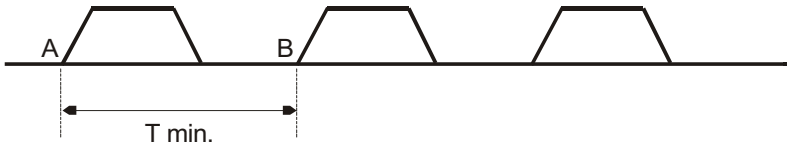


(2) Feed Step Control Mode



Note: The maximum value of P1-45 = 125 x T min.

T min. is the minimum time from A to B, i.e. the time between when start running at A and when start running at B (please refer to the figure below). Time unit is 1 second.



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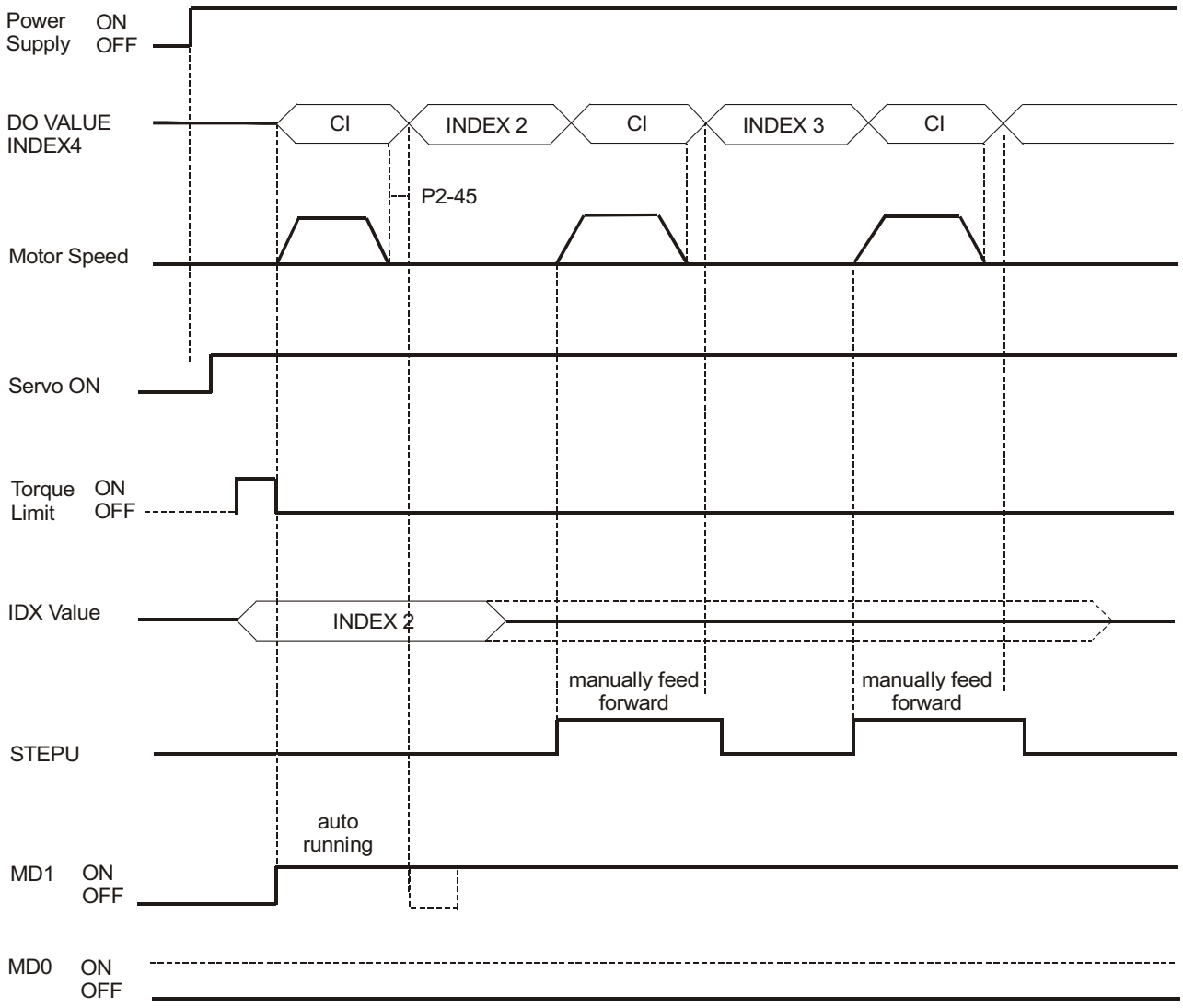
(3) Manually Single Step Control Mode 1



Note:

1. When manually feed forward operation occurs, please set MD1 to be ON first (The feed step selection input should be kept unchanged to avoid returning to INDEX1 when manually feed forward operation occurs).
2. For manually single step operation speed, please refer to parameter P2-36.

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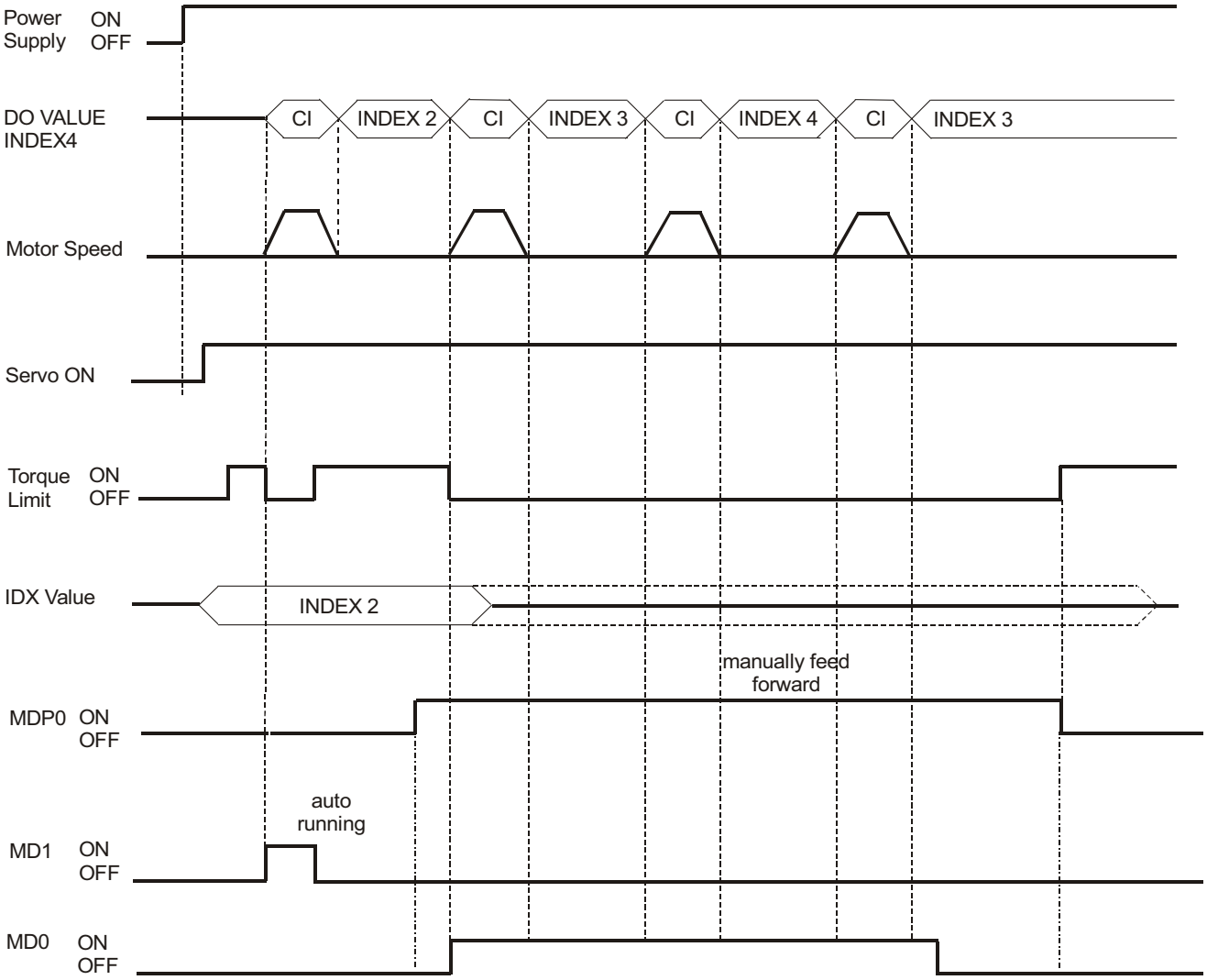
(4) Manually Single Step Control Mode 2



📖 Note:

1. After manually feed forward operation is completed, please set MD1 and MD0 to be OFF and then turn MDP1 from ON to OFF (ready to enter torque decrease status) to avoid any abnormal condition.
2. In manually feed forward mode (MDP1 is ON), if the rising-edge of MD0 is ON, then the servo motor will single step feed forward and if the rising-edge of MD1 is ON, then the servo motor will single step feed reverse.
3. For manually single step operation speed, please refer to parameter P2-37.

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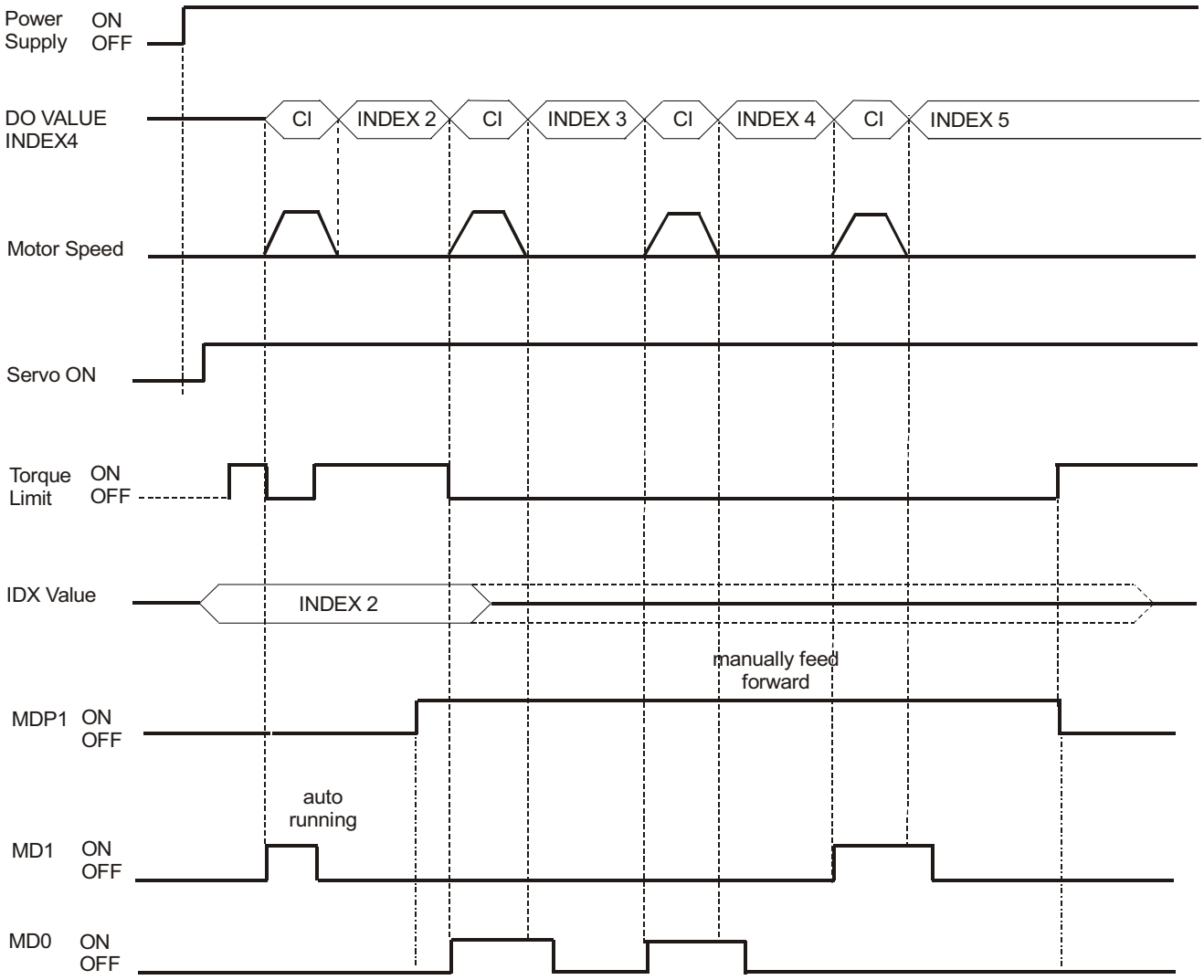
(5) Manually Continuous Step Control Mode



Note:

1. After manually feed forward operation is completed, please set MD1 and MD0 to be OFF and then turn MDP0 from ON to OFF (ready to enter torque decrease status) to avoid any abnormal condition.
2. In manually feed forward mode (MDP0 is ON), if MD0 is ON, then the servo motor will continuous step feed forward and if MD1 is ON, then the servo motor will continuous step feed reverse.
3. For manually single step operation speed, please refer to parameter P2-37.

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■ Communication Control Example Explanation

Communication Address	Communication Content	Explanation
H306	H0FF	Set to software control
H407	H020	SERVO ON
H407	H060	HOMING
H407	H070	HOME SENSOR ON
H407	H060	HOME SENSOR OFF
H407	H020	Torque decrease
H407	H0A3	Index 3
H407	H023 (H020)	Torque decrease
H407	H0A5	Index 5
H407	H025 (H020)	Torque decrease
H407	H0An	Index n
H407	H02n (H020)	Torque decrease

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12-7 Internal Auto Running Mode

■ Relevant Parameters Description

Parameter	Communication Address	Parameter Description
P1-01	0101H	Control Mode and Output Direction 001: Forward torque in Pr mode 101: Reverse torque in Pr mode
P1-33	0121H	Position Control Mode (Pr) 5: Continuous auto-running position command (Absolute) 6: Continuous auto position command (Incremental)
P1-34	0122H	Acceleration Time 1st to 3rd step Acceleration time (When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled)
P1-35	0123H	Deceleration Time 1st to 3rd step Deceleration time (When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled)
P1-36	0124H	Accel /Decel S-curve When parameter P1-36 is set to 0, accel / decel function is disabled, i.e. P1-34, P1-35 is disabled.
P1-44	012CH	Electronic Gear Ratio (1st Numerator) (N1) If the electronic gear deceleration ratio is 1/75, set numerator to 75
P1-45	012DH	Electronic Gear Ratio (Denominator)
P1-47	012FH	Homing Mode 202: When (MD1, MD0)=(OFF, ON), Forward Homing 203: When (MD1, MD0)=(OFF, ON), Reverse Homing
P1-50	0132H	Homing Offset Rotation Number
P1-51	0133H	Homing Offset Pulse Number Total homing offset pulse number =P1-50 x 10000 + P1-51
P2-44	022CH	Digital Output Mode Setting 0: General output mode 1: Combination output mode
P2-45	022DH	Combination Output Signal Delay Time [UNIT: 4msec] Output signal will hold delay time when position command is completed.
P2-51	0233H	Internal Servo ON setting

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When the setting value of the time listed below is set to zero(0), the relative position will be ignored.

Positioning Point	Position Command Register	Moving Speed Register	Dwell Time Register
INDEX1	(P1-15, P1-16)	P2-36 (V1)	P2-52 (T1)
INDEX2	(P1-17, P1-18)	P2-37 (V2)	P2-53 (T2)
INDEX3	(P1-19, P1-20)	P2-38 (V3)	P2-54 (T3)
INDEX4	(P1-21, P1-22)	P2-39 (V4)	P2-55 (T4)
INDEX5	(P1-23, P1-24)	P2-40 (V5)	P2-56 (T5)
INDEX6	(P1-25, P1-26)	P2-41 (V6)	P2-57 (T6)
INDEX7	(P1-27, P1-28)	P2-42 (V7)	P2-58 (T7)
INDEX8	(P1-29, P1-30)	P2-43 (V8)	P2-59 (T8)

■ Digital I/O Signal Setting

DI Signal	Parameter Setting	Explanation
DI1 (SON)	P2-10 = 101	Servo ON
DI2 (AUTOR)	P2-11 = 142	Auto run input
DI3 (STEPD)	P2-12 = 140	Step down input
(STEPU)	P2-12 = 139	Step up input
(STEPB)	P2-12 = 141	Step back input.
DI4 (SHOM)	P2-13 = 127	Move to “Home”
DI5 (ORGP)	P2-14 = 124	Reference “Home” sensor
DI6 (CWL)	P2-15 = 22 (contact “b”)	Reverse Inhibit limit
DI7 (CCWL)	P2-16 = 23 (contact “b”)	Forward Inhibit limit
DI8 (EMGS)	P2-17 = 21 (contact “b”)	Emergency stop

DO Signal	Parameter Setting	Explanation
DO1	P2-18 = 101	Please refer to “Definition of DO Signals” in the following section.
DO2	P2-19 = 103	
DO3	P2-20 = 109	
DO4	P2-21 = 105	
DO5	P2-22 = 107	

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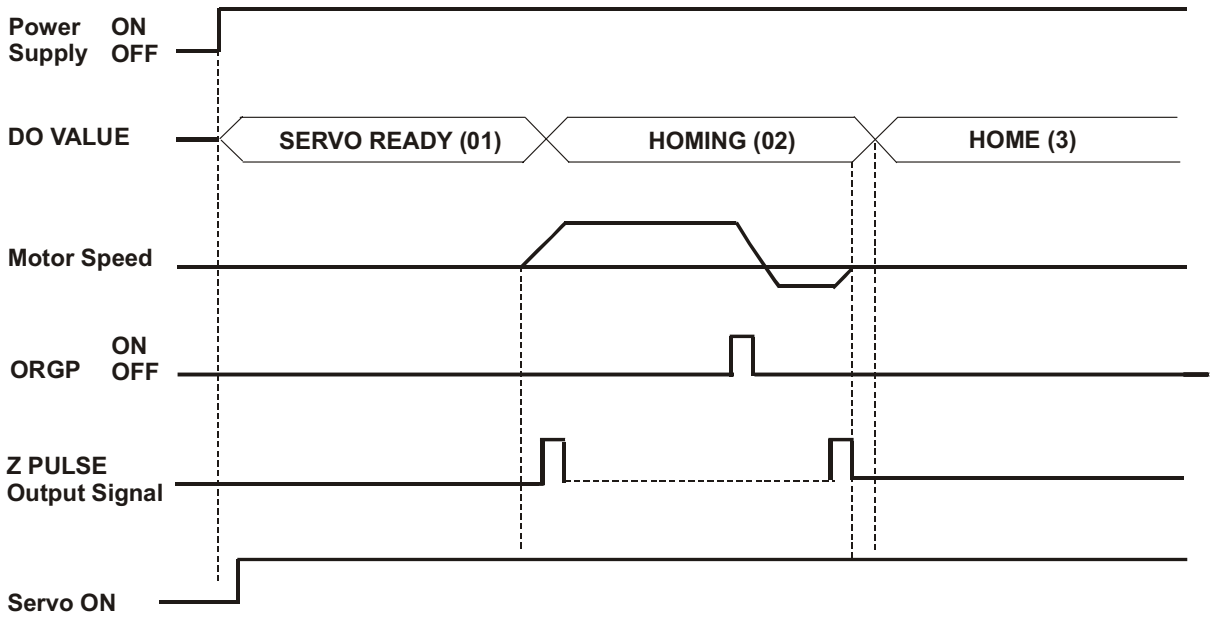
■ Definitions of DO Signals

(ON:1, OFF:0)

Nr.	DO5	DO4	DO3	DO2	DO1	Function
1	0	0	0	0	0	ALARM
2	0	0	0	0	1	SERVO READY
3	0	0	0	1	0	HOMEING (under operation)
4	0	0	0	1	1	HOME Completed
5	0	0	1	0	0	CHANGE INDEX (under operation) (CHANGE INDEX hereinafter called “CI”)
6	0	0	1	0	1	INDEX 1 (In position)
7	0	0	1	1	0	INDEX 2 (In position)
8	0	0	1	1	1	INDEX 3 (In position)
9	0	1	0	0	0	INDEX 4 (In position)
10	0	1	0	0	1	INDEX 5 (In position)
11	0	1	0	1	0	INDEX 6 (In position)
12	0	1	0	1	1	INDEX 7 (In position)
13	0	1	1	0	0	INDEX 8 (In position)

■ Timing charts of DI/DO Signals Operation

(1) Homing Mode



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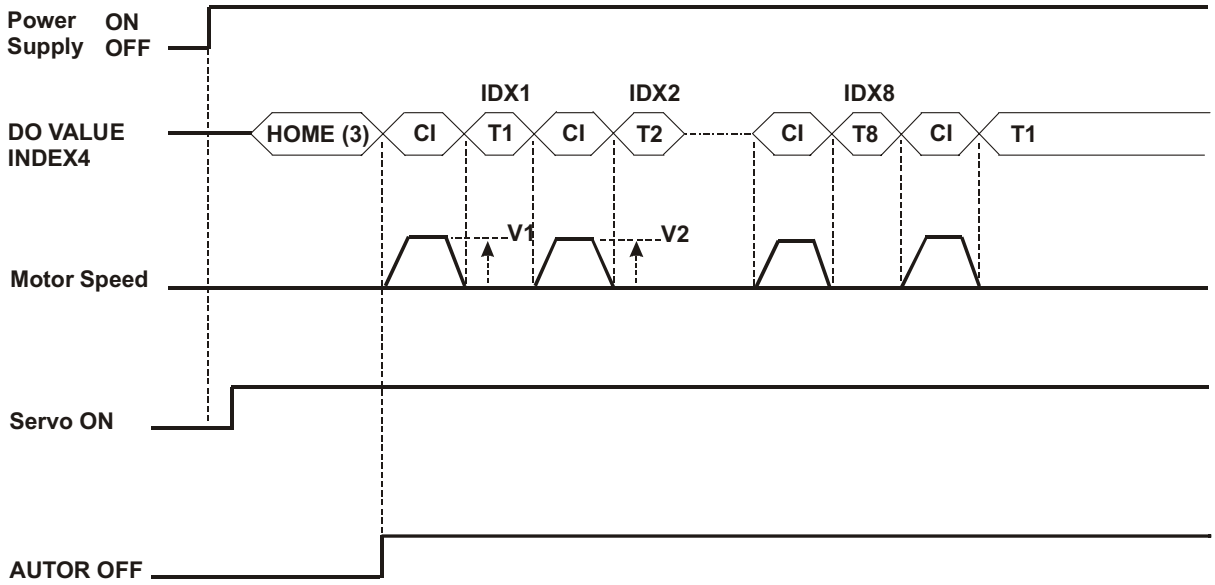
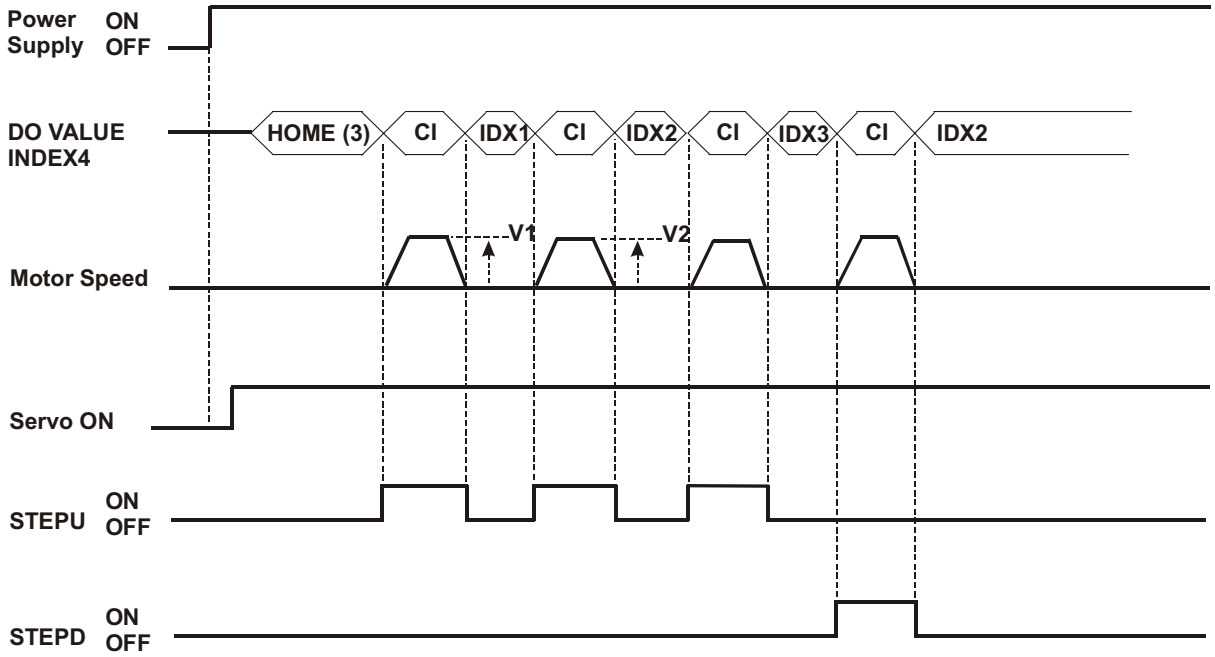
(2) Auto Running Mode



(3) Manual Control Mode 1



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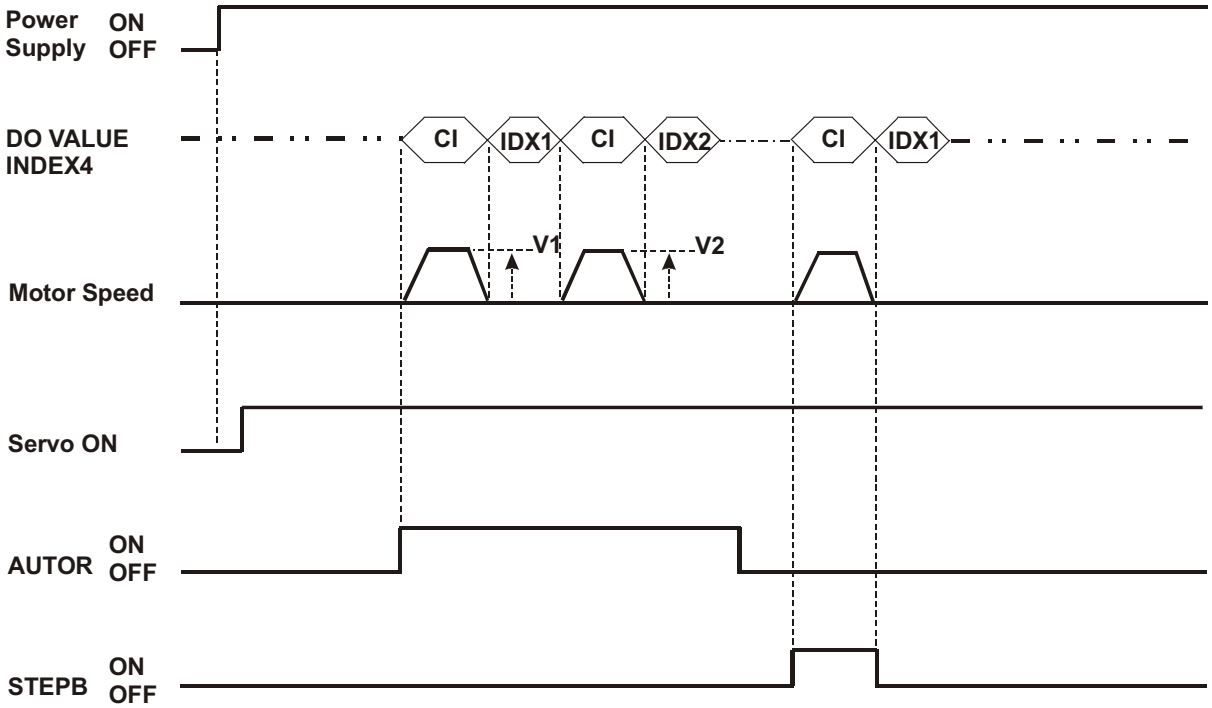
(4) Manual Control Mode 2



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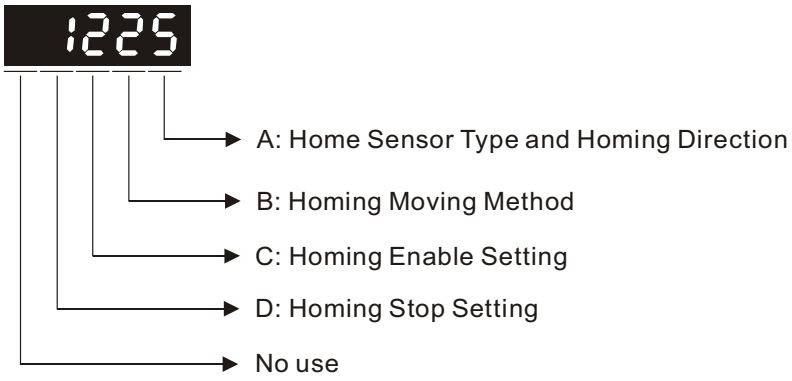
12-8 Homing Function

■ Relevant Parameters Description

Parameter	Communication Address	Parameter Description
P1-47	012FH	Homing Mode 
P1-48	0130H	1st Speed Setting of High Speed Homing
P1-49	0131H	2nd Speed Setting of Low Speed Homing
P1-50	0132H	Homing Offset Rotation Number
P1-51	0133H	Homing Offset Pulse Number

■ Relevant Parameters Description, cont.

Parameter	Communication Address	Parameter Description
P1-34	0122H	Acceleration Time
P1-35	0123H	Deceleration Time
P1-36	0124H	Accel /Decel S-curve

■ Explanation of Homing Mode

(1) A: Home Sensor Type and Homing Direction

Left or right limit switch can be used as a reference “Home” for homing function. It also can use extra sensor, such as proximity switch or photo switch as reference “Home”. When the servo motor runs within one revolution only, users also can set Z-phase pulse as a reference “Home”.

A=0: Forward homing and CCWL limit input point is regarded as a rough reference “Home”. When home is in position, CCWL will turn into limit input function. If trigger CCWL afterward, the limit alarm will occur. When use limit input point as a rough reference “Home”, we recommend users to set B=0, i.e. return to find Z-phase pulse during homing and regard Z-phase pulse as a precise mechanical “Home”.

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A=1: Reverse homing and CWL limit input point is regarded as a rough reference “Home”. When home is in position, CWL will turn into limit input function. If trigger CWL afterward, the limit alarm will occur. When use limit input point as a rough reference “Home”, we recommend users to set B=0, i.e. return to find Z-phase pulse during homing and regard Z-phase pulse as a precise mechanical “Home”.

A=2: Forward homing and ORGP (Reference “Home” sensor) is regarded as a reference “Home”. At this time, users can set B=0, i.e. return to find Z-phase pulse during homing and regard Z-phase pulse as a precise mechanical “Home” or set B=1, i.e. do not return and go forward to find Z-phase pulse and regard Z-phase pulse as a precise mechanical “Home”. If users do not use Z-phase pulse as mechanical “Home”, users can set the rising-edge of ORGP as the mechanical “Home” (B=2).

A=3: Reverse homing and ORGP (Reference “Home” sensor) is regarded as a reference “Home”. At this time, users can set B=0, i.e. return to find Z-phase pulse during homing and regard Z-phase pulse as a precise mechanical “Home” or set B=1, i.e. do not return and go forward to find Z-phase pulse and regard Z-phase pulse as a precise mechanical “Home”. If users do not use Z-phase pulse as mechanical “Home”, users can set the rising-edge of ORGP as the mechanical “Home” (B=2).

A=4: Forward-finding Z-phase pulse “Home”. This function is usually used when the servo motor runs within one revolution. The servo motor can not be connected to any external sensor switch at this time.

A=5: Reverse-finding Z-phase pulse “Home”. This function is usually used when the servo motor runs within one revolution. The servo motor can not be connected to any external sensor switch at this time.

(2) B: Homing Moving Method

B=0: After find reference “Home” (after homing completed), the servo motor returns in 2nd step speed to find the nearest Z-phase pulse as the mechanical “Home”.

B=1: After find reference “Home” (after homing completed), the servo motor does not return and continue to go forward in 2nd step speed to find the nearest Z-phase pulse as the mechanical “Home”.

B=2: When A=2 and A=3, find the rising-edge of sensor ORGP as the mechanical “Home” and stop according to deceleration time. When A=4 and A=5, stop according to deceleration time after find Z-phase pulse.

(3) C: Homing Enable Setting

There are two settings for enabling homing function. One is automatically enable homing function and the other is enable homing function by input contact (SHOM).

C=0: Disable homing function.

When C is set to 0, it indicates that homing function is disabled no matter what other parameter

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values are.

C=1: Enable homing function automatically after power in connected to the servo drive.

This function is valid only when power on and servo on. It is used on condition that it doesn't need to repeat the execution of homing function when the servo drive is operating. Use this function can save an input contact which is used for executing homing function.

C=2: Enable homing function by SHOM input contact.

To use this function, set any one of register of parameter P2-10 ~ P2-17 (Digital Input Terminal 1 ~ 8) to SHOM. The setting value of parameter P2-10 ~ P2-17 should be 127(contact "a") or 27(contact "b"). Then, user can enable the homing function by triggering SHOM input contact at any time when the servo drive is operating.

(4) D: Homing Stop Setting

D=0: After detecting "Home", the motor will decelerate and return to "Home".

After get the home sensor signal in 2nd step speed operation, the motor will decelerate and stop. After the servo motor stops, the then move to the position of mechanical "Home".

D=1: After detecting "Home", the motor will decelerate and stop in the forward direction.

After get the home sensor signal in 2nd step speed operation, the motor will decelerate and stop. After the servo motor stops, the over distance will not be corrected. The position of mechanical "Home" will not change by the difference of the over distance.

■ Recommended Homing Modes

According to various use requirements and corresponds to difference setting values of C and D, the recommended setting values of A and B are shown as below:

B \ A	0	1	2	3	4	5
0	Y	Y	Y	Y	N	N
1	N	N	Y	Y	N	N
2	N	N	Y	Y	Y	Y

(Y=Yes, N=No)

■ Homing Timing Charts

(1) Timing Charts of Enable Homing Mode

1. Automatically enable homing function when power on (C=1)

After homing is completed, if any one of output function definition (DO) of parameter P2-18 ~ P2-22 is HOME (setting value is 09 or 109), the corresponding output terminal will generate output signal immediately (Active). If servo on input signal is canceled or any alarm occurs in the process of homing, the homing function will terminate and do not output homing completed signal.

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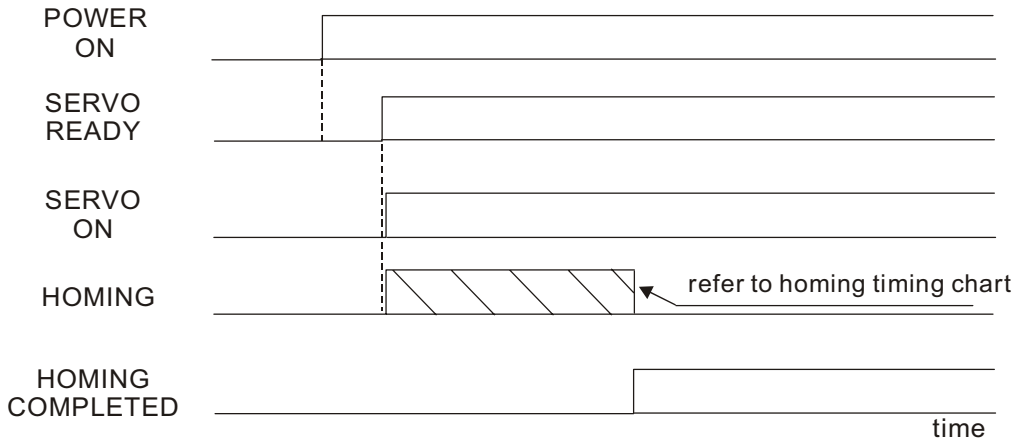
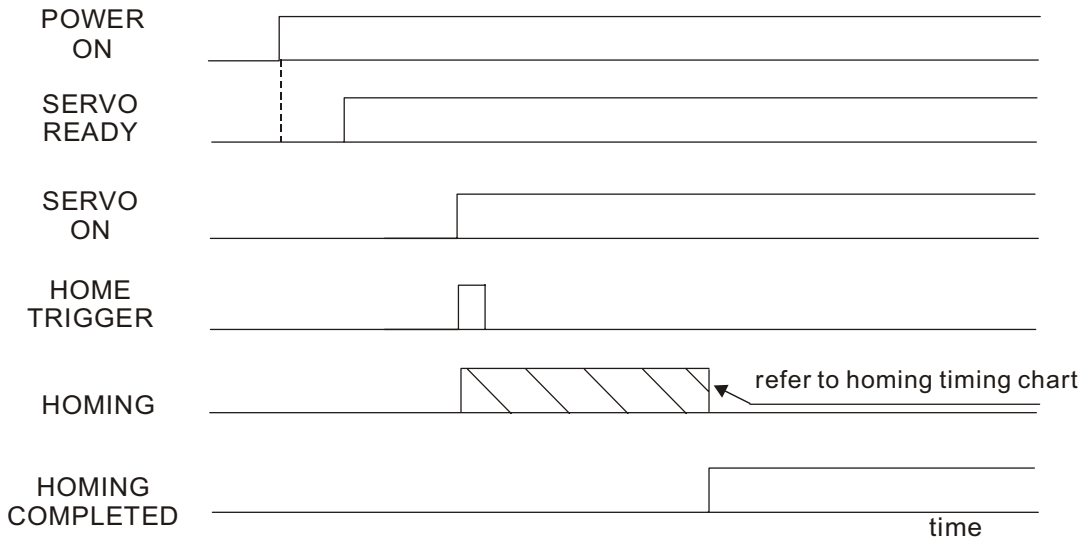
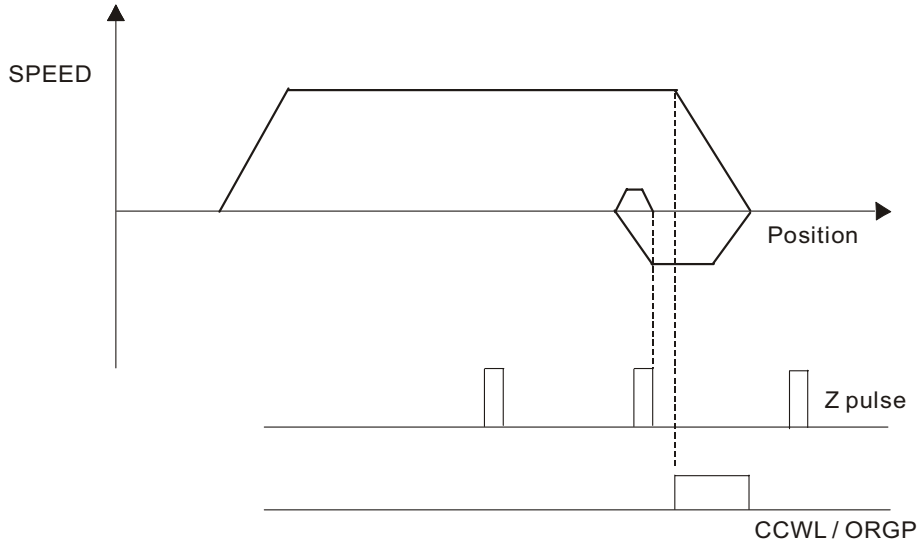


2. Enable homing function by input contact (SHOM) (C=2)



(2) Homing Timing Charts

1. B/A = 0/0 or B/A = 0/2



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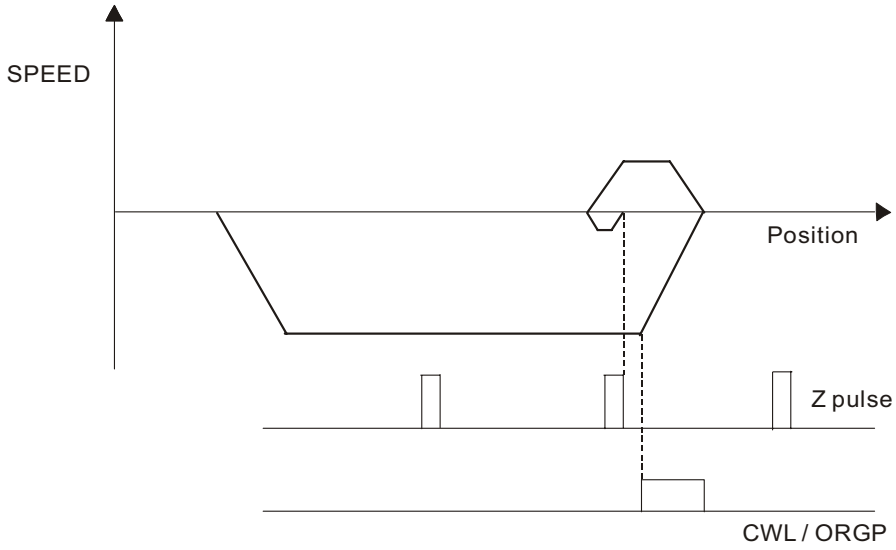
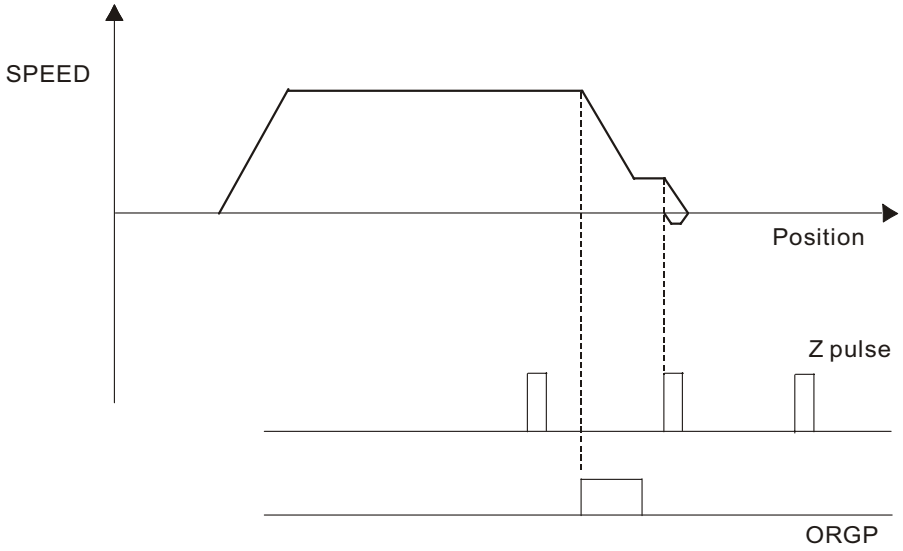
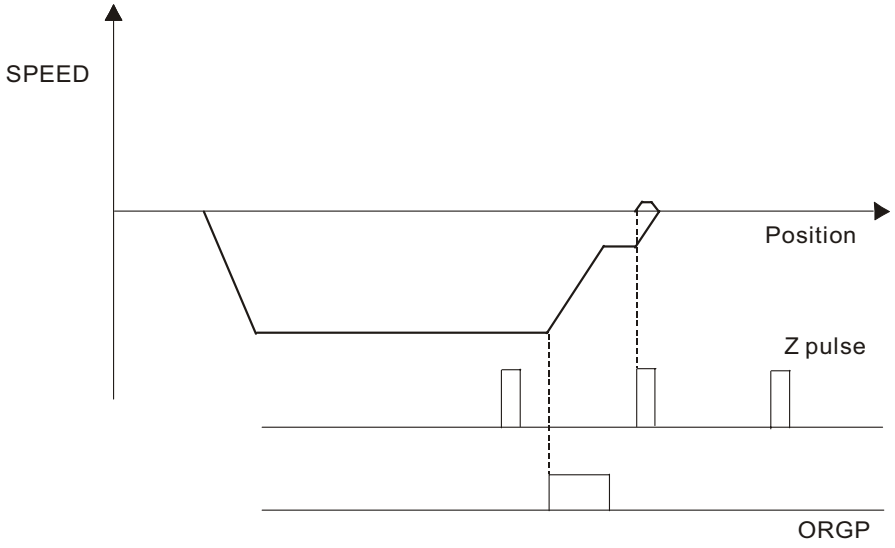
2. B/A = 0/1 or B/A = 0/3



3. B/A = 1/2



4. B/A = 1/3



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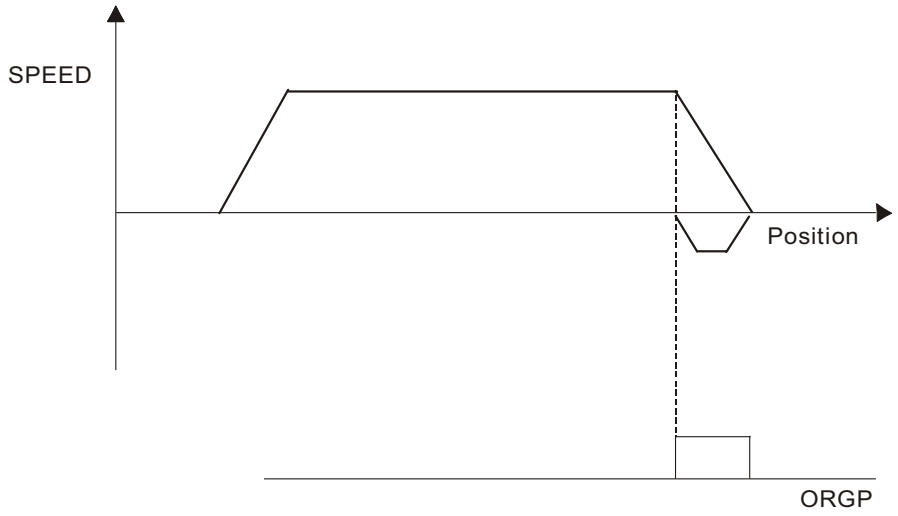
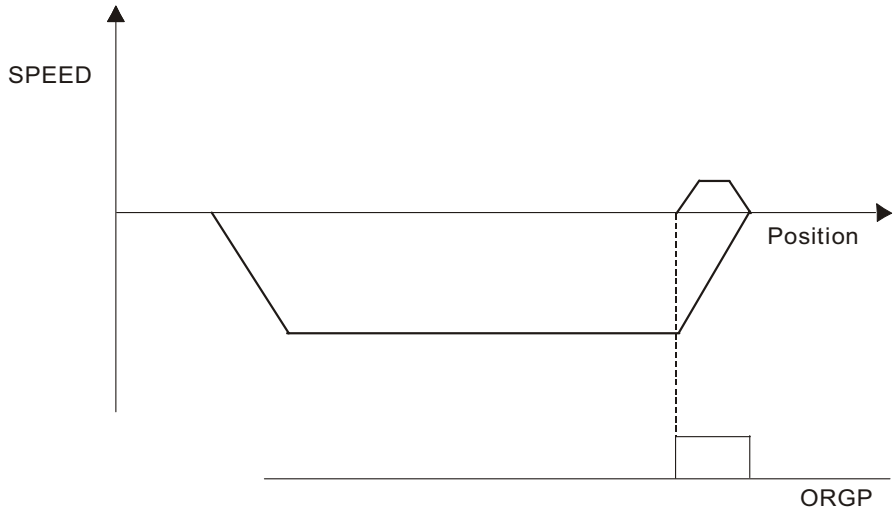
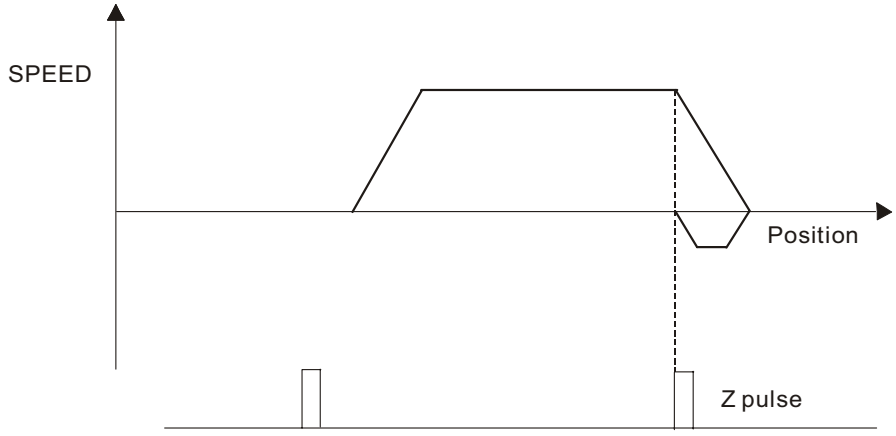
5. B/A = 2/2



6. B/A = 2/3



7. B/A = 2/4



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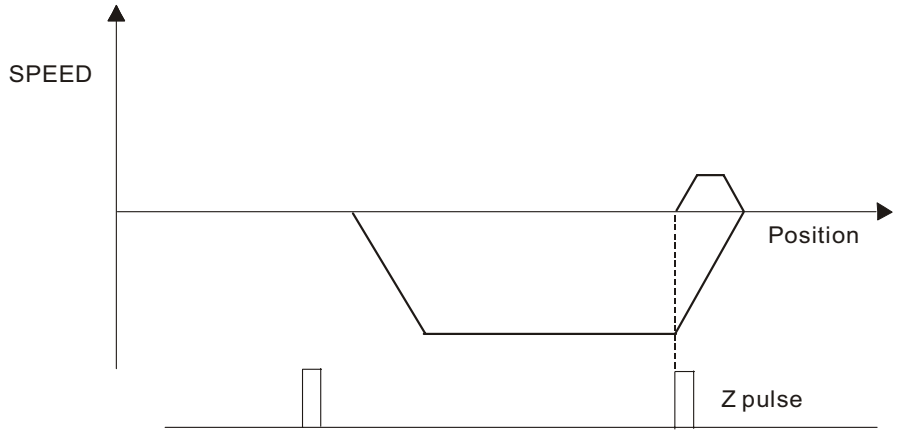
8. B/A = 2/5



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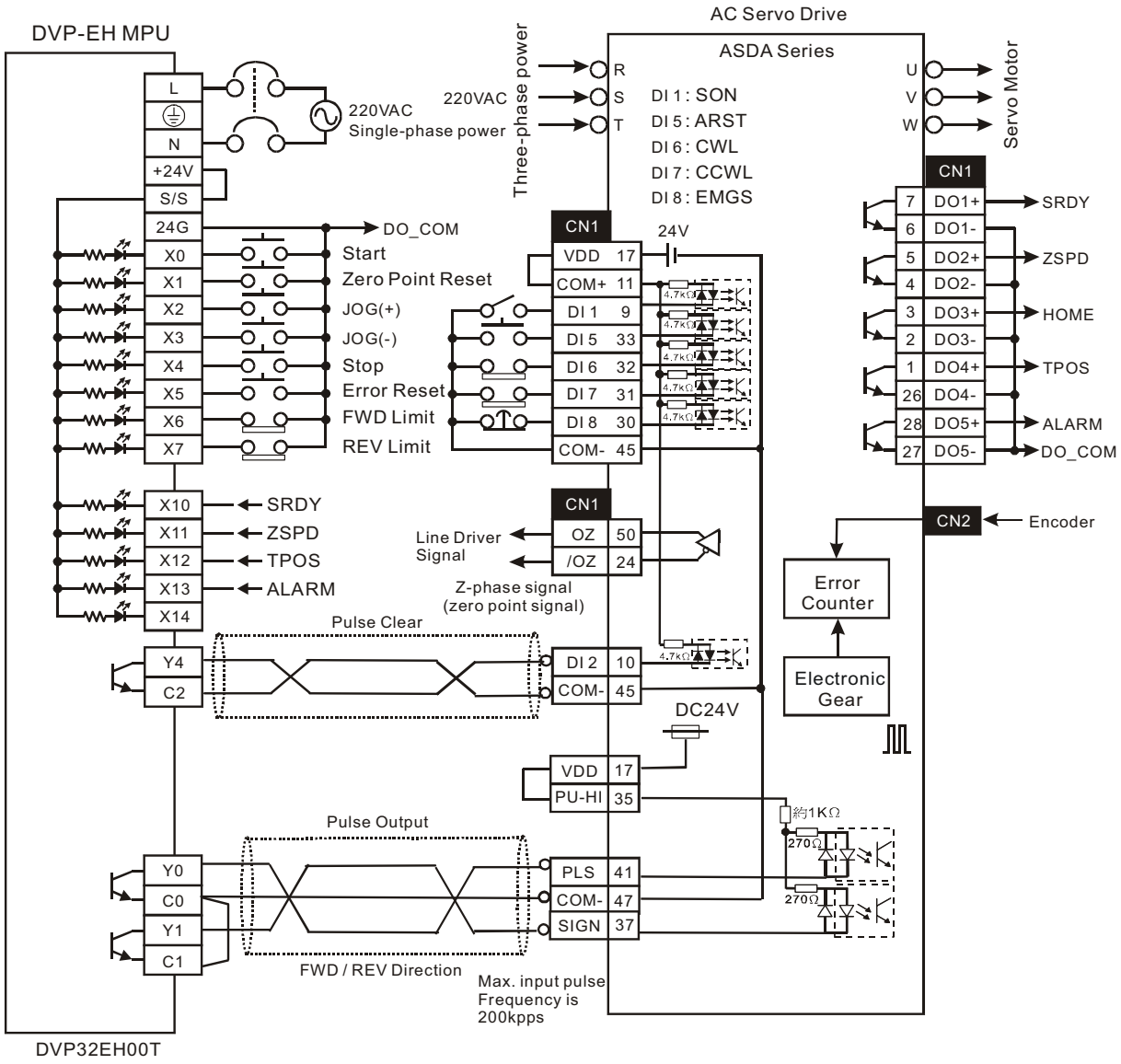
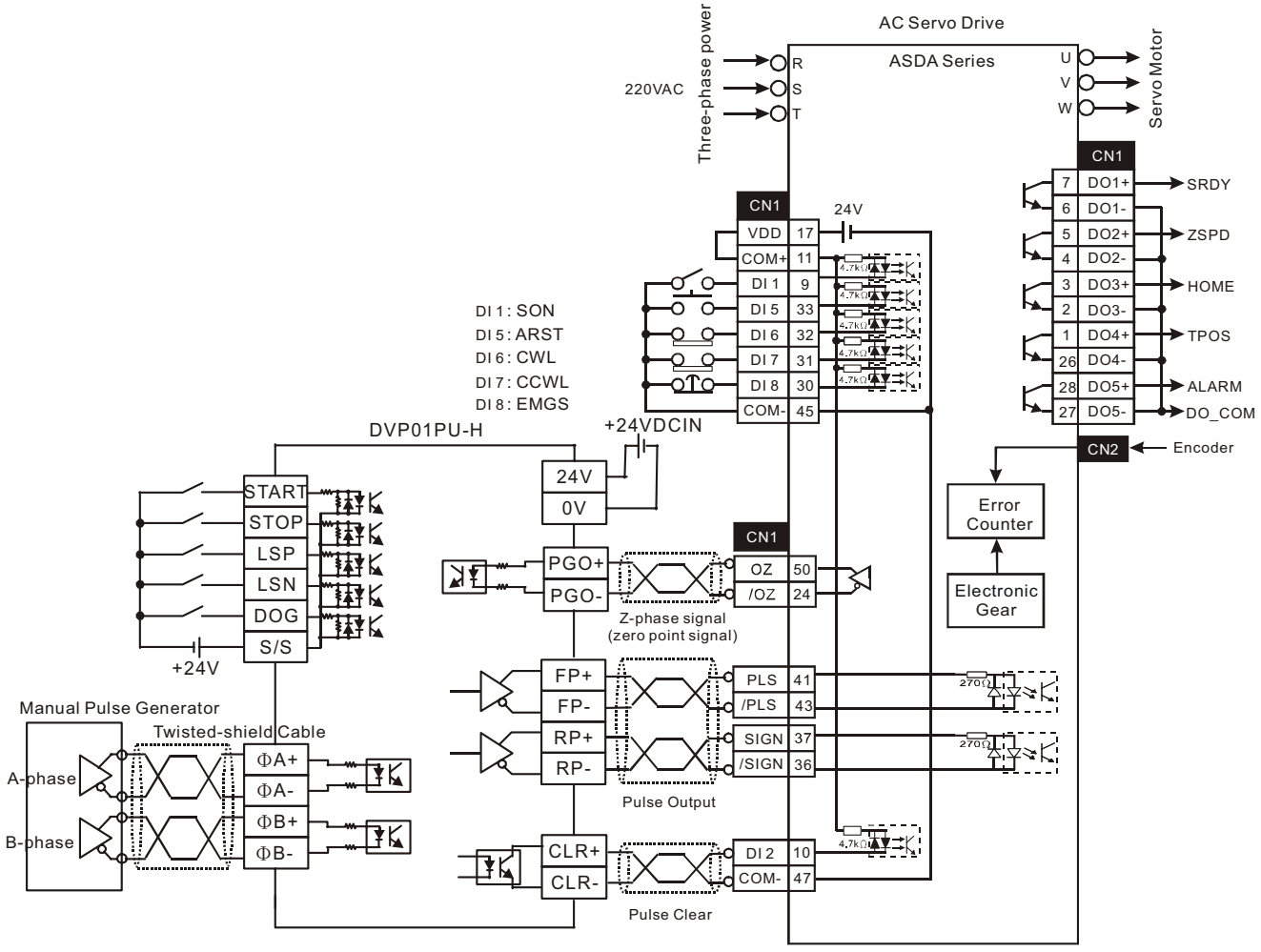
12-9 External Controller Connection Examples

■ Connecting to Delta DVP-EH PLC



■ Connecting to Delta DVP-01PU



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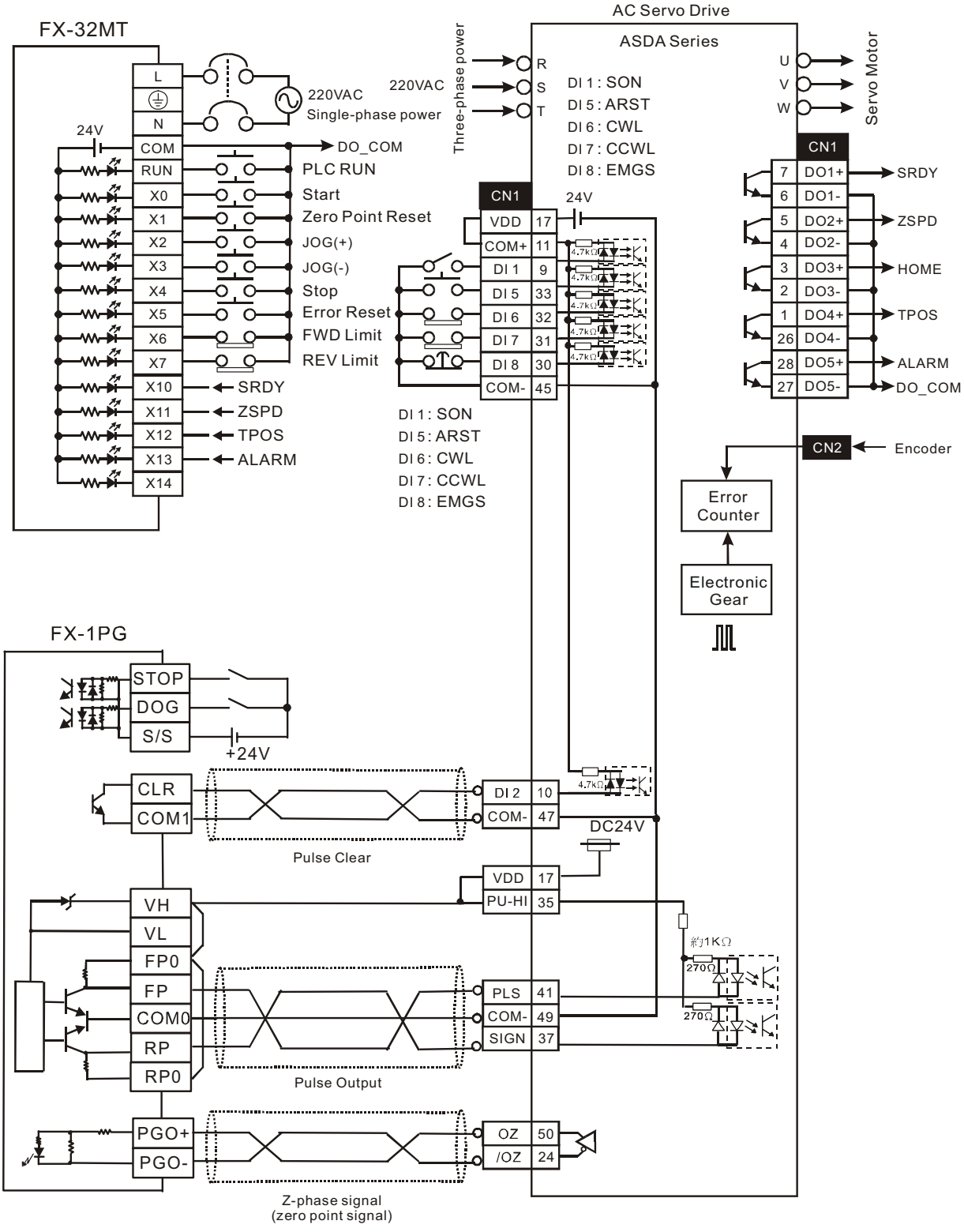
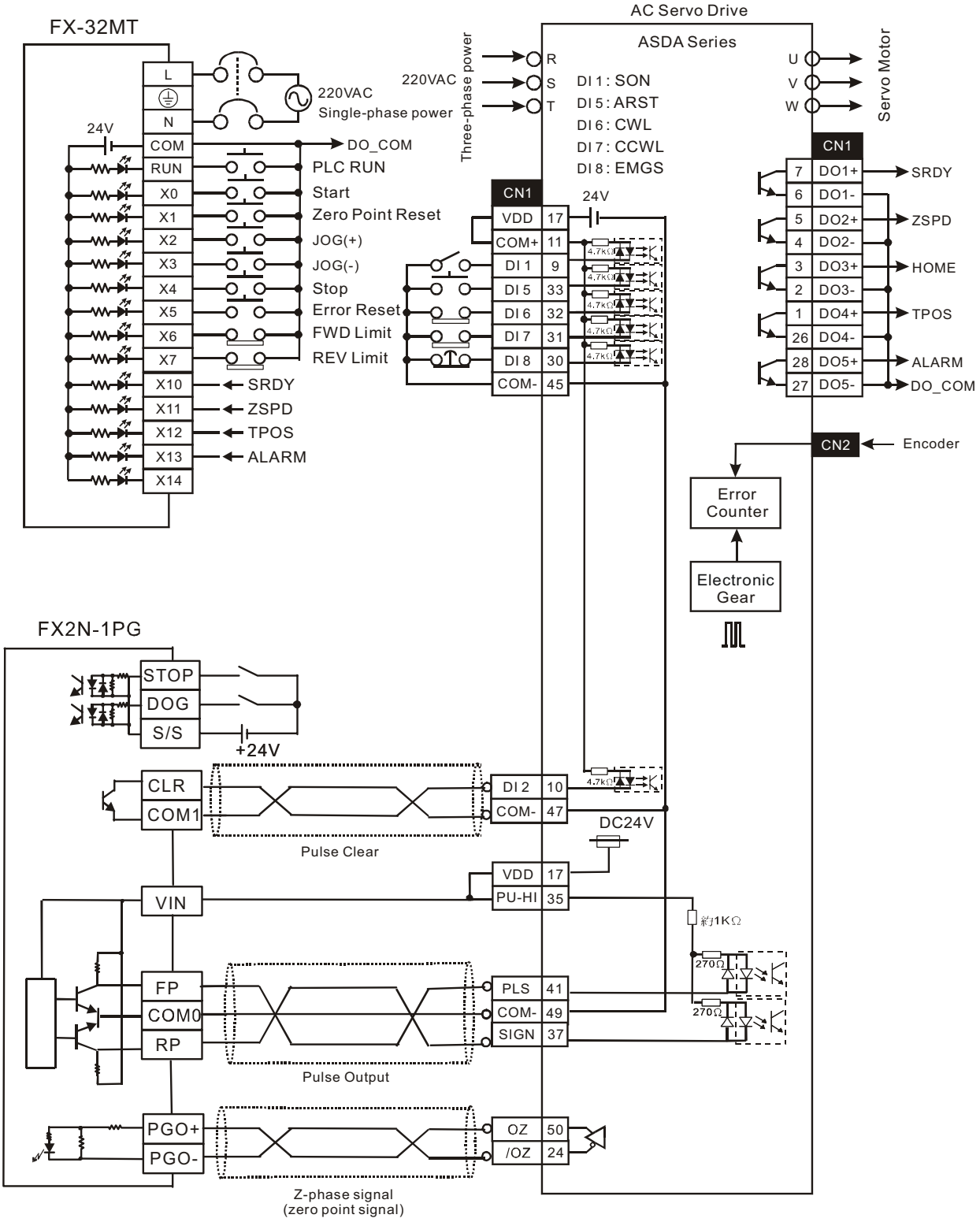
■ Connecting to Mitsubishi FX1PG



■ Connecting to Mitsubishi FX2N1PG



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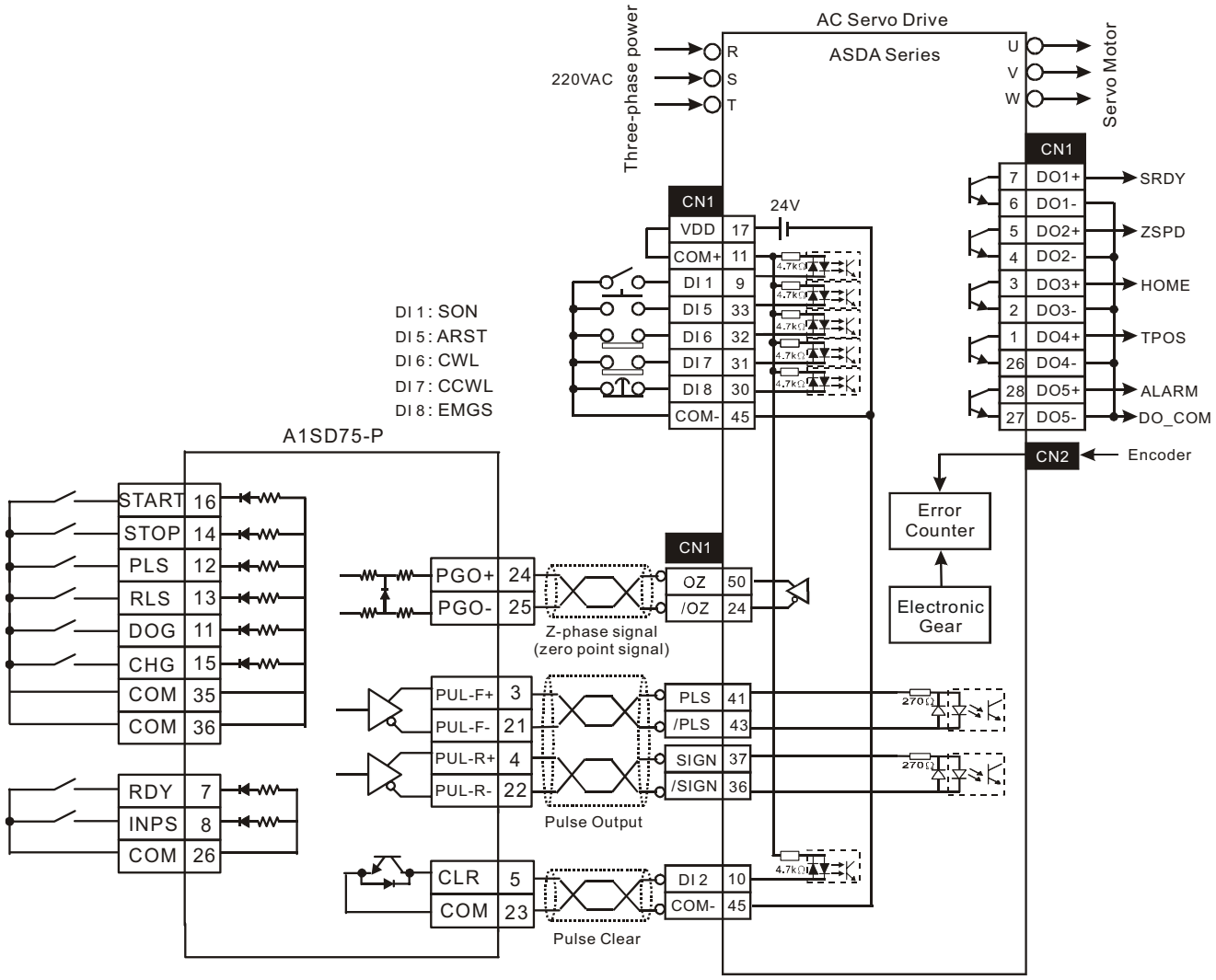
■ Connecting to Mitsubishi AD75



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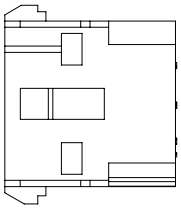
Appendix A: Accessories

■ Power Connectors

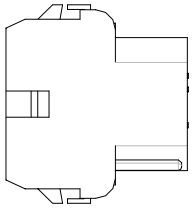
Delta Part Number: ASD-CAPW0000 (100W ~750W)

AMP:350780-1



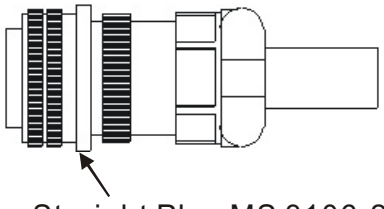
Delta Part Number: ASD-CAPW0100 (100W ~750W with brake)

AMP:350781-1



Delta Part Number: ASD-CAPW1000 (low inertia 1kW ~3kW and medium inertia 1kW~1.5kW)

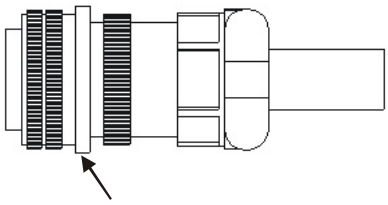
CLAMP:MS3057-12A



Straight Plug MS 3106-20-18S

Delta Part Number: ASD-CAPW2000 (medium inertia 2kW ~3kW)

CLAMP:MS3057-16A



Straight Plug MS 3106-24-11S

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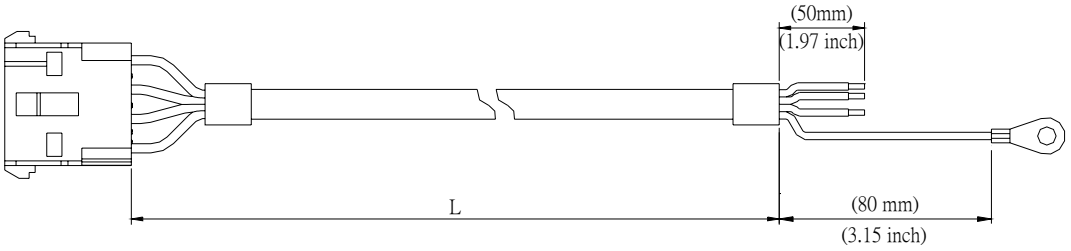
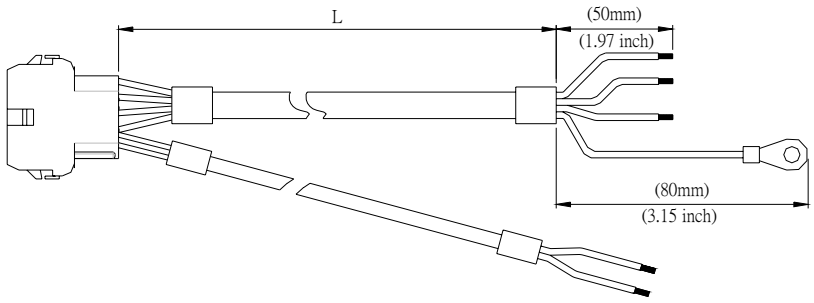
■ Power Cables

Delta Part Number: ASD-CAPW0003, ASD-CAPW0005 (100W ~750W)



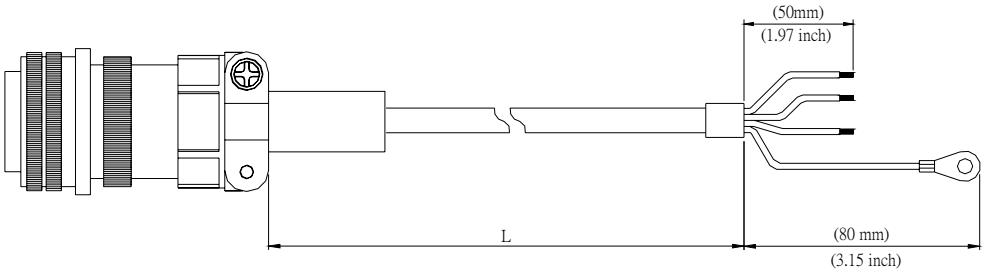
Item	Part No.	L	
		mm	inch
1	ASD-CAPW0003	3000±10	118±0.4
2	ASD-CAPW0005	5000±10	197±0.4

Delta Part Number: ASD-CAPW0103, ASD-CAPW0105 (100W ~750W with brake)



Item	Part No.	L	
		mm	inch
1	ASD-CAPW0103	3000±10	118±0.4
2	ASD-CAPW0105	5000±10	197±0.4

Delta Part Number: ASD-CAPW1003, ASD-CAPW1005 (1kW ~1.5kW)



Item	Part No.	Straight plug	L	
			mm	inch
1	ASD-CAPW1003	MS 3106-20-18S	3000±10	118±0.4
2	ASD-CAPW1005	MS 3106-20-18S	5000±10	197±0.4

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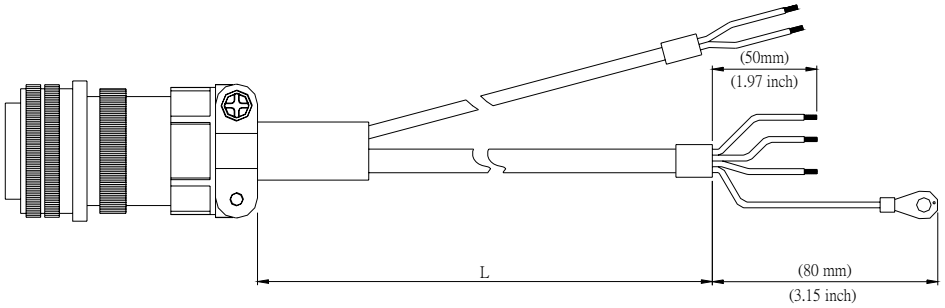
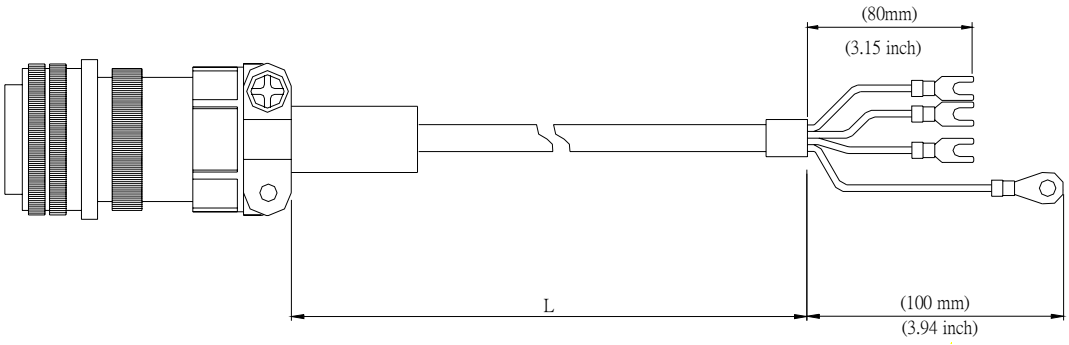
■ Power Cables, cont.

Delta Part Number: ASD-CAPW1103, ASD-CAPW1105 (1kW ~1.5kW with brake)



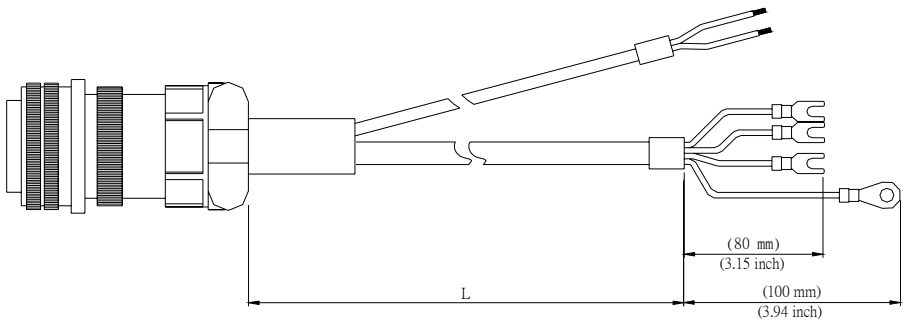
Item	Part No.	Straight plug	L	
			mm	inch
1	ASD-CAPW1103	MS 3106-20-18S	3000±10	118±0.4
2	ASD-CAPW1105	MS 3106-20-18S	5000±10	197±0.4

Delta Part Number: ASD-CAPW1203, ASD-CAPW1205 (low inertia 2kW ~3kW)



Item	Part No.	Straight plug	L	
			mm	inch
1	ASD-CAPW1203	MS 3106-20-18S	3000±10	118±0.4
2	ASD-CAPW1205	MS 3106-20-18S	5000±10	197±0.4

Delta Part Number: ASD-CAPW1303, ASD-CAPW1305 (low inertia 2kW ~3kW with brake)



Item	Part No.	Straight plug	L	
			mm	inch
1	ASD-CAPW1303	MS 3106-20-18S	3000±10	118±0.4
2	ASD-CAPW1305	MS 3106-20-18S	5000±10	197±0.4

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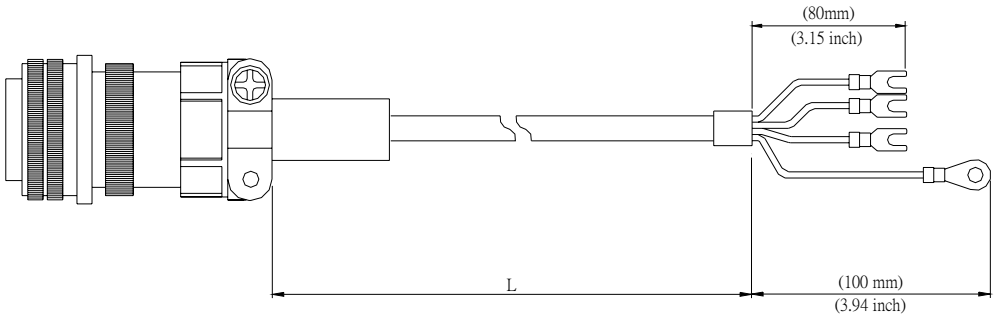
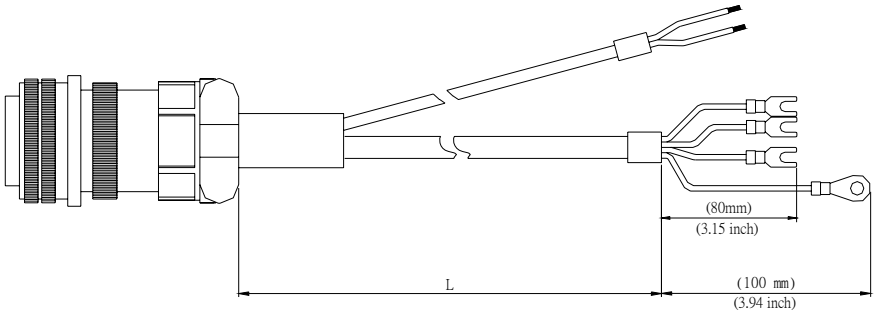
■ Power Cables, cont.

Delta Part Number: ASD-CAPW2203, ASD-CAPW2205 (medium inertia 2kW ~3kW)



Item	Part No.	Straight plug	L	
			mm	inch
1	ASD-CAPW2203	MS 3106-24-11S	3000±10	118±0.4
2	ASD-CAPW2205	MS 3106-24-11S	5000±10	197±0.4

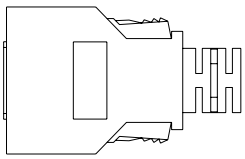
Delta Part Number: ASD-CAPW2303, ASD-CAPW2305 (medium inertia 2kW ~3kW with brake)

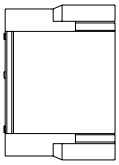


Item	Part No.	Straight plug	L	
			mm	inch
1	ASD-CAPW2303	MS 3106-24-11S	3000±10	118±0.4
2	ASD-CAPW2305	MS 3106-24-11S	5000±10	197±0.4

■ Encoder Connectors

Delta Part Number: ASD-CAEN0000 (100W ~750W)





HOUSING:AMP (1-172211-0)

Vendor Name	Vendor P/N
3M TAIWAN LTD	10120-3000VE
3M TAIWAN LTD	10320-52A0-008

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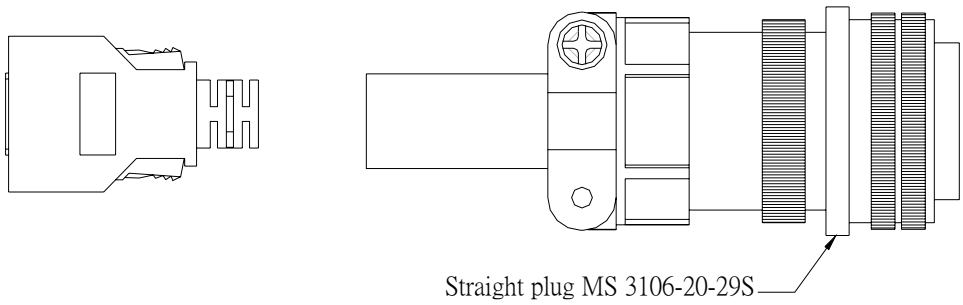
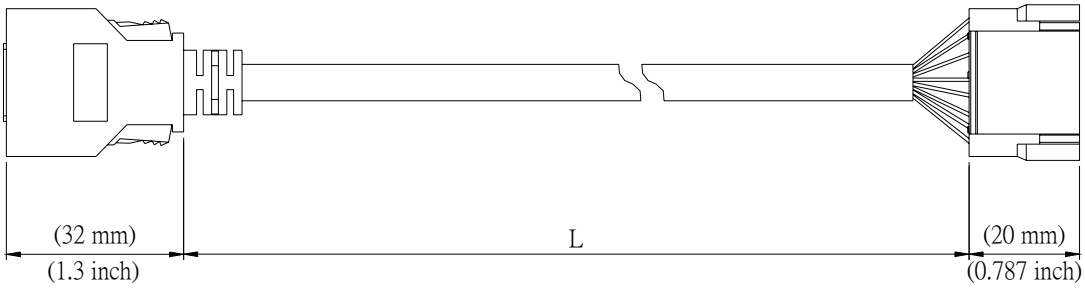
■ Encoder Connectors, cont.

Delta Part Number: ASD-CAEN1000 (1kW and 1kW above)



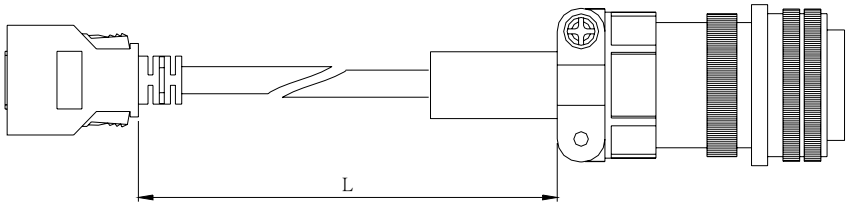
■ Encoder Cables

Delta Part Number: ASD-CAEN0003, ASD-CAEN0005 (100W ~750W)



Item	Part No.	L	
		mm	inch
1	ASD-CAEN0003	3000±10	118±0.4
2	ASD-CAEN0005	5000±10	197±0.4

Delta Part Number: ASD-CAEN1003, ASD-CAEN1005 (1kW and 1kW above)



Item	Part No.	Straight plug	L	
			mm	inch
1	ASD-CAEN1003	MS 3106-20-29S	3000±10	118±0.4
2	ASD-CAEN1005	MS 3106-20-29S	5000±10	197±0.4

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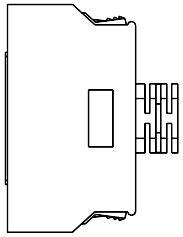
■ I/O Signal Connector

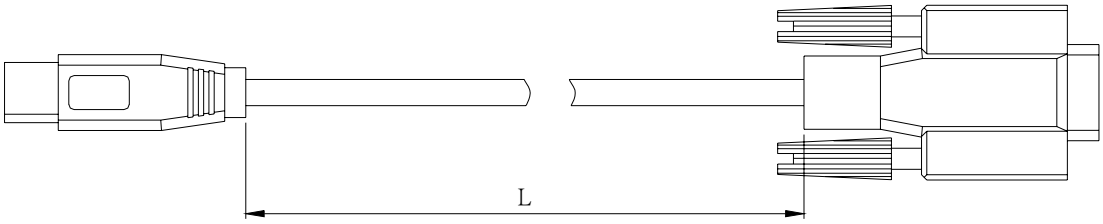
Delta Part Number: ASD-CNSC0050

Vendor Name	Vendor P/N
3M TAIWAN LTD	10150-3000VE
3M TAIWAN LTD	10350-52A0-008



■ Communication Cable between Drive and Computer

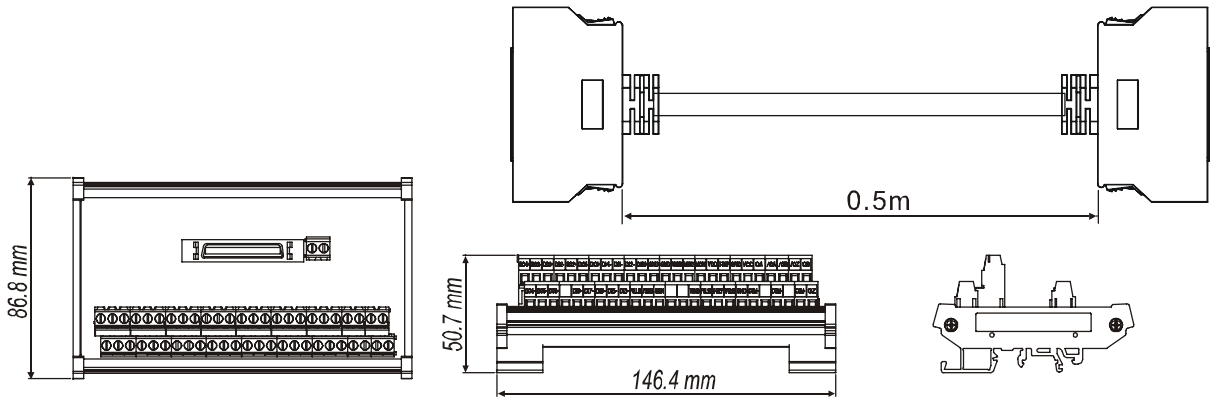
Delta Part Number: ASD-CARS0003



Item	Part No.	L	
		mm	inch
1	ASD-CARS0003	3000±10	118±0.4

■ Terminal Block

Delta Part Number: ASD-BM-50A



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